BROWN & WILLIAMSON TOBACCO CORPORATION
RESEARCH SERVICES DEPARTMENT

RESTRICTED

EVALUATION OF THE KAMM HOLDER FOR EFFECTS ON VENTILATION, TAR AND OTHER CIGARETTE SMOKE DELIVERIES

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Introduction and Summary of Test Results

A. Purpose of the Test

In early 1982, Philip Morris, Inc. undertook a study purportedly designed to measure ventilation of Barclay cigarettes in a group of human test subjects. The tests, as well as later tests performed by Philip Morris' "independent" testing laboratory, the U.S. Testing Company, were conducted with an experimental device especially constructed for testing Barclays, the "Puff Parameter Analyzer" ("PPA").

On the basis of these tests Philip Morris concluded -- and argued to the FTC -- that Barclay's ventilation is reduced by 30% in "normal" human smoking. The FTC has endorsed this view in its current litigation against Brown & Williamson.

Two explanations have been advanced for the alleged reduction in ventilation during smoking of Barclays:

first, that smokers crush Barclay's ventilation channels with their lips, and second, that smokers occlude the ventilation channels, blocking them at the very end of the filter tip with their lips.

Our consultant, Dr. Roger Kamm, has determined that the average pressure exerted by human lips during normal smoking is about 34 torr.* Our consultant, Dr. Louis Fine, has determined, from intra-oral fiber optic viewing of Barclay smokers, that occlusion is more likely to occur at relatively shallow insertion depths.

Based in part on the work of Drs. Fine and Kamm in seeking to devise artificial lips for use in cigarette testing, Dr. Kamm has designed an experimental cigarette holder, fitted with a silicone rubber tubing which, when inflated, replicates the pressure exerted by human lips on a cigarette filter during normal smoking. We have used this holder to perform a series of tests to determine Barclay's ventilation rates and tar, nicotine, and carbon monoxide delivery, at a variety of simulated lip pressures and insertion depths. The pressures and insertion depths used in

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* Kamm, Roger D., "PRESSURE MEASURING TESTS," Communication to Brown & Williamson Tobacco Corporation. In Dr. Kamm's studies he measured pressure in terms of "torr". Brown & Williamson's test equipment measured pressure in terms of millimeters of mercury ("mm Hg"). These measurements are precisely equivalent, however, because one torr is equal to one mm Hg.

these tests reflect our best understanding of actual human lip pressures and insertion depths in smoking.

The Kamm holder was constructed to permit replication, as closely as possible, of the three parameters considered to be of primary importance in affecting ventilation of Barclay cigarettes: lip pressure, depth of filter insertion in the mouth, and "lip drape". Moreover, the tests we performed with the Kamm holder were designed to present a conservative or "worst case" simulation: lip pressures to 85 and 100 torr, well above the 34 torr average known to exist in human smoking, long insertion length (to 10 mm) to maximize opportunities for channel crushing, and short insertion length (to 4 mm) to maximize opportunities for "lip drape". Insertion depth is defined as the length from the filter end of the cigarette that is inserted in the Kamm holder.

The Kamm holders used in this test were fitted with two different moduli of silicone rubber tubing. The modulus of the tubing determines its relative compliance or stretchiness. By changing the modulus of the tubing in the Kamm holder, it is possible to simulate different degrees of "lip drape." The low modulus tubing is the thinnest walled, most compliant material available, and provides for maximum "lip drape," consistent with the "worst case" design of the test.

We performed ventilation and smoke delivery tests on Barclay 85 KS cigarettes with the Kamm holder.

A. Ventilation Tests

For purposes of the ventilation study, 12 cigarettes were tested at each of: (a) 15 pressures (0, 15, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 85 and 100 mm of Hg., or torr); (b) 4 insertion depths (4, 6, 8 and 10 mm); and (c) two tubings of different modulus (low and medium) for BARCLAY 85 KS cigarettes. The same cigarette was tested at each level of pressure.

Cigarette ventilation data for individual cigarettes are listed in Appendix A. Averages, standard deviations, and sample sizes appear at the righthand side of Table A1 in each row. A single column (read vertically) within an insertion length is the same cigarette. Differences from initial cigarette ventilation at 0 or atmospheric pressure are similarly summarized in Figure A2. Notably, in the worst possible case -- at the shallowest (4 mm) insertion depth and highest (100 torr) pressure with the low modulus tubing -- the average decrement in ventilation was not 30%, but 14.5%.

At conditions giving the largest decrements in ventilation, the ranges of ventilation values from test cigarette to test cigarette are the greatest. Although the

cause for this variation is not completely known, it is most likely the result of variations in filter construction and in the axial orientation of the cigarette in the Kamm holder, or of the greater difficulty of sealing the cigarette in the Kamm holder at the relatively shallow insertion depths.

Figures 3-12 grouped the data to examine trends. In these figures, "*" represents the average decrease in cigarette ventilation from its initial reading. The "H" and "L" denote the high and low readings respectively. Figures 11-12 show average changes in ventilation, overlayed for the different insertion length, for each modulus of tubing.* The significant results of these tests are summarized as follows:

1. Cigarette ventilation is most impaired with decreasing insertion length and increasing pressure. (Figures 11 and 12)

2. For the two shallowest insertion lengths used

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* Regression analyses were applied to the data in Figures 11-12. The regression model that is shown below was selected for regressing pressure (X) on the change in ventilation (Y).

$$Y = A + BX^2 \quad (1)$$

The coefficients (A and B) are listed in Figure 13. In addition, the correlation coefficients, r^2, are provided. A perfect correlation between pressure and change in ventilation yields a correlation coefficient of 1.0. Note that all r^2 are close to 1.0. This indicates the model is a good approximation of the relationship between pressure and change in ventilation.

in these tests (4 and 6 mm), ventilation decreases more with the low modulus tubing, which simulates maximum "lip drape," than with the medium modulus tubing. (Compare Figures 11 and 12) At the 4 mm depth with maximum (100 torr) pressure with the low modulus tubing, the lowest average rate of ventilation recorded was 71%. However, even at this 4 mm depth, with maximum applied pressure and low modulus tubing, average ventilation rates as high as 86% were recorded. (Figure A1)

3. At the more moderate 8 mm insertion depth, with pressures of 35 torr -- near the average in human smoking -- the average ventilation rate was 85.82%.

4. For both moduli of tubing, test cigarettes inserted to 8 and 10 mm depths yield about the same rates of ventilation across the range of applied pressures. In other words, there is little difference between the 8 and 10 mm insertion depths. (Figures 11, 12)

5. The amount of variation among test cigarettes, in both ventilation and delivery, is most dramatic at the shallowest insertion depths, with the highest applied pressures, especially with the low modulus tubing. (Figures A1, B1)

B. Smoke Delivery Tests

Samples from the same population of BARCLAY KS cigarettes used in the ventilation study were used for smoking

experiments. Twelve ports were smoked for each of 18 combinations (2 moduli x 3 insertion lengths x 3 pressures) of test variables.* Each 12 port sample was randomized across two smoking machines and different runs. Smoke deliveries at 0 torr (atmospheric pressure) for this population of BARCLAY were previously determined using standard FTC smoke procedures (see Figure 14).

Summary statistics for smoke deliveries are shown in Figures 15-17. All of the smoking data are listed in Appendix B. Procedures for measuring smoke delivery are given in Appendix E. Data in Appendix B for tar, nicotine, filter nicotine, filter efficiency and water are presented in columns representing six "replicates." The values given for each replicate represent an average result for ten cigarettes. Data for carbon monoxide and puffs are presented in Appendix B in columns representing 12 replicates. The values given for each replicate represent an average result for five cigarettes.

Graphs of smoke deliveries by tubing are provided in Figures 18-31.

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* For purposes of the smoking tests, we abandoned the 10 mm insertion depth, which proved to perform much like the 8 mm insertion depth in the ventilation studies. Also, due to time limitations, only 35 torr, 50 torr and 85 torr pressure variables were employed.

All smoking data were evaluated using a technique called analysis of variance ("ANOVA"). ANOVAs are summarized in Appendix C.* Generally, ANOVAs showed that average differences greater than 0.1 mg/cig. of tar, 0.02 mg/cig. of nicotine, and 0.1 mg/cig. of CO are statistically significant at α = 0.05 (95% confidence level). Other tests of statistical significance for ancillary smoking data are provided in Appendix C.

The significant results of the smoke delivery tests are summarized as follows:

1. In the very worst case, applying simulated lip pressures (up to 85 torr) well above the known average (34 torr), and the shallowest possible insertion depth (4 mm), with maximum simulated lip drape (low modulus tubing), the average tar delivery recorded was 1.5 mg. per cigarette. (Figure B1)

2. At the highest applied pressure (85 torr), and shallowest insertion depth (4 mm) with the low modulus tubing, the average nicotine delivery recorded was .18 mg./cg. (Figure B1)

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* ANOVA is a well-recognized statistical method for determining the isolated effect of each specific test variable, and the effects of each possible combination of test variables. See, e.g., B. Ostle, Statistics in Research (Iowa State Univ. Press, 1963).

3. At the more moderate 8 mm insertion depth, with applied pressures near the human average (35 torr), with the low modulus tubing, average tar delivery was 0.6 mg/cig., while average nicotine delivery was .07 mg/cig.

4. The data showed that, over the range of applied pressures and insertion depths with both moduli of tubing, tar delivery did not increase to levels even approaching those indicated by Philip Morris' work with the puff parameter analyzer. With this test apparatus, we determined that pressure of 175 torr -- more than five times the average pressure in human smokers -- is required to reduce ventilation on a Barclay 30% (i.e., to achieve a 60% ventilation rate). With our test apparatus, we smoked 2 samples of 16 ports each at 175 torr, using insertion depths of 6 and 8 mm and the medium modulus tubing. At the 6 mm insertion depth, the maximum tar delivery recorded was 5.4 mg. The minimum tar delivery recorded at the same insertion depth and pressure was 3.2 mg., while the average was 4.1 mg. (Figure 32)

5. CO deliveries are consistent with tar and nicotine and follow the same trends. (see Appendix C and Figure 16 for more detail).

Data shown below summarize results from all experiments:

Average Tar Delivery (mg/cig.) and Ventilation Rate (%)
at Different Pressures (mm Hg)

Insertion Length (mm)	0 mm		35 mm		50 mm		85 mm	
	Vent	Tar	Vent	Tar	Vent	Tar	Vent	Tar
Low Modulus								
4	85.5	ND*	83.1	0.7	80.4	0.9	73.6	1.5
6	85.3	ND	84.6	0.8	83.5	0.8	78.8	1.5
8	86.2	ND	85.8	0.6	85.4	0.7	83.4	1.0
Medium Modulus								
4	86.8	ND	85.1	0.8	83.8	0.7	78.2	1.3
6	87.1	ND	86.4	0.6	85.8	0.7	83.0	1.1
8	87.7	ND	87.4	0.6	87.1	0.6	86.0	1.0

Medium Modulus, 175 mm Hg

Insertion Length (mm)	Vent	Tar
6	58.9	4.1
8	64.0	2.9

* ND = not determined. At 0 pressure, it was difficult to seal the test cigarettes in the Kamm holder sufficiently to ensure good results in a test for tar delivery. Accordingly, tar values at 0 (atmospheric) pressure were determined by the FTC method, and are set forth in Figure 14.

TEST APPARATUS

1. Kamm Assembly. Figure 1 shows the Kamm assembly. The parts are described as follows:

a) Kamm Holder. The Kamm Holder is machined from a cast acrylic rod. Dimensions are given in the figure. The stainless pressure tubing is pressed into the acrylic wall and sealed with epoxy glue. The pressure tubing is .040" ID HPLC stainless tubing manufactured by Waters Assoc.

b) Kamm Collar. The Kamm Collar is machined from a cast acrylic rod. Dimensions are given in the figure.

c) Kamm Tubing. Dimensions of the Kamm tubing are given in the figure. The tubing is made of silicone rubber and is manufactured by: Bivona Surgical Instrument Inc., 5700 West 23rd Avenue, Gary, Indiana 46404. Specifications of the tubing are as follows:

Characteristic	Low Modulus	Medium Modulus
Silicone Material (General Electric	SE 5218	SE 845
Durometer (Shore A)	25 ± 5	40 ± 5
Tensile strength (psi)	1000	1200
Tear strength (psi)	100	200
Ultimate elongation (%)	800	800
Tensile Modulus		
at 50% (psi)	55	
100% (psi)	80	120
200% (psi)	110	

2. Pressure/Ventilation Apparatus. The pressure/ventilation apparatus is shown in Figure 2.

3. Cast Acrylic Rod. 0.625" and 0.875" diameter, AIN Plastics, Inc., 249 E. Sanford Blvd., Mt. Vernon, N.Y. 10550.

4. Pressure Tubing. Stainless steel .040" I.D. for HPLC. Waters Associates, Milford, MA 01757.

5. Smoking Machine. Brewer Automatic Pipetting Machine, Model 60470. Modified to take a 35 cc puff volume of 2 second duration.

6. Pressure Transducer. Model DP103-10, Validyne Engineering Corporation, Northridge, CA 91324

7. Laminar Flow Tubes. 1/4" copper tubing. 1118 mm long. Distance between flow measuring point = 203 mm.

8. Analog to Digital Converter. Data Acquisition System A113. Interactive Structure, Inc., Bala Cynwyd, PA.

9. Microcomputer. Apple II Plus.

10. Gelman Holder, Gelman Sciences, Medical Device Division, 674 S. Wagner Avenue, Ann Arbor, MI 48106.

11. Puff Parameter Analyzer. This device was similar to the device used by Philip Morris in its ventilation tests. The glass envelope is approximately 135 mm long with a uniform diameter of about 90 mm. The opening at the end of the envelope that accommodates the ventilation holder is 14 mm in diameter.

12. Ventilation Holder. Grip holder fitting for cigarettes manufactured by Filtrona Instruments, England.

13. Pressure Regulator. (To provide air pressure at smoking machine.) Nullmatic 0-100 inches of water. Moore Products Co., Spring House, PA.

EXPERIMENTAL PROCEDURE

The pressure/ventilation apparatus shown in Figure 2 was used to measure the effects on cigarette ventilation of pressure applied to the Kamm holder. Referring to that figure, the Kamm holder (C) is assembled by inserting the Kamm tubing through the plastic cylinder. An air tight seal is made by folding the tubing back and over the rim of the plastic holder. O-rings are slid over the grooves in the holder to insure an air tight seal. The holder/tubing assembly is then inserted into the Kamm collar (B). A Gelman holder (A) is inserted into the other end of the Kamm collar. Photographs of the Kamm assembly are shown in Appendix D.

The ventilation envelope (D) is a Filtrona cigarette holder with dental dam wrapped over each end and sealed with O-rings. The ventilation opening is attached to a pressure transducer (F). The ventilation envelope is attached to the puff parameter analyzer, a glass envelope (E), the other end of which is connected to a pressure transducer (F). A cigarette is inserted through the ventilation envelope and

into the puff parameter analyzer so that the tipping perforations are positioned inside the ventilation envelope. The filter end of the cigarette is then inserted into the Kamm holder to the designated insertion depth. The entire apparatus is now ready to be used for testing. Photographs of the apparatus are shown in Appendix D.

The testing sequence consisted of the following operation:

1. Take a standard puff (35 cc puff volume, 2.0 second duration) on the unlit cigarette.

2. By use of the calibrated pressure transducers, A/D converters, and Apple computer, record puff duration, puff volume through cigarette tobacco section, puff volume through ventilation holes, total puff volume, and percent ventilation. All tests are carried out on an unlit cigarette. Repeat puffing for a total of three puff cycles.

3. Using attached pressure syringe, apply desired amount of pressure as indicated by mercury manometer. Then repeat Steps 1 and 2 on each cigarette that is tested.

4. Repeat steps 1, 2 and 3, applying pressures at fifteen graduated increments ranging from 0 to 100 mg Hg. (torr).

The pressure transducers used to measure flow are assembled and calibrated as follows:

Taps are brought out of each of the laminar flow elements, and a Validyne DP103-10 differential pressure transducer is hooked to each. The taps are about 203 mm apart and are the same on both elements. The differential transducers then measure the pressure drop across the 203 mm length of tubing. Since the flow is laminar, this pressure is linearly proportional to the flow through the system.

The transducers are attached to individual carrier/ demodulators, giving the ability to adjust both span and zero independently of the vent and tobacco section sides.

The two transducer electrical outputs are attached to two channels of multi-channel A/D converter which are interfaced to an Apple II microcomputer. The computer software is designed to detect puff activity when the vent side signal reaches an operator selectable level for an operator selectable number of data points. When this trigger occurs, both the vent and the tobacco side output are summed separately for the duration of the puff. These operations are performed in machine code for maximum acquisition speed. The raw numbers are then converted into volume readings in a BASIC program.

The calibration procedure involved the following steps:

1. Set the transducer output so that it is compatible with the input requirements of the A/D converter.

2. Hook the two laminar flow elements in series so that the flow through both is the same.

3. Attach a 50 cc syringe to the combined laminar flow elements so that when the plunger is pressed inward, the resulting positive flow causes positive electrical outputs from the transducers.

4. For each calibration, take a number of volume/flow rate readings ranging from 3 cc to 50 cc. Relate these to the output voltage from the transducers using a standard least square fit.

5. Enter the resulting equation into the BASIC program to convert the transducer output into flow rate readings. We have found that the correlation between puff volume and integrated transducer signal is consistently high (typically >0.97).

6. Confirm the resulting calibration by inserting a cigarette or standard of known ventilation rate and check calibration by using a one port syringe type smoking machine (Brewer automatic pipette) set to a 35 cc/2 sec. puff.

Cigarettes used in this study were taken from regular production at the Macon Branch. They represent

May 2, 1983 production. The cigarettes were conditioned for at least 24 hours prior to testing.* Insertion length marks were placed on the tipping at 4 mm, 6 mm, 8 mm, and 10 mm from the mouth end. Cigarettes from this population were used for both ventilation experiments and for smoking experiments.

Two standard Phipps & Bird smoking machines and standard B&W smoking procedures were used to measure tar at various holder pressures. Standard methods for tar, carbon monoxide, nicotine, and water determination are given in Appendix E of this report. The combined Kamm assembly and Gelman holder was weighed before and after smoking to obtain TPM values. The smoking machine was modified by bringing compressed air through a precision regulator and then to the machine through small Tygon tubing (1/16" I.D.). Each port was fitted with a pressure source that would allow pressures from 0 to 90 torr. Pressure was measured at the source of the pressure just after the regulators and after the last port connection to be sure that there were no leaks during smoking. Photographs of the smoking machine are shown in Appendix D.

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* It is standard procedure in the tobacco industry, as is recognized by the FTC, to condition cigarettes before performing tests like these. Cigarettes are conditioned by allowing them to sit at 75° Fahrenheit and 60% relative humidity for at least 24 hours prior to testing.

Conclusion

Philip Morris contends that the cigarette ventilation of BARCLAY is reduced to about 60% because of blockage of the grooves by human smokers and that tar delivery is 3-7 mg/cig.

With this apparatus we experimentally determined that a pressure of 175 torr or mm of Hg (3 psi), far exceeding that exerted by human lips, is necessary to obtain a cigarette ventilation of about 60%. We then smoked two samples of 16 ports each at 175 mm of pressure for two insertion lengths (6 mm and 8 mm) and a medium modulus Kamm tubing. Smoking results and cigarette ventilation are shown in Figure 32. At this extreme pressure, tar deliveries increased to 3-4 mg/cig., and nicotine deliveries increased to 0.4-0.5 mg/cig.

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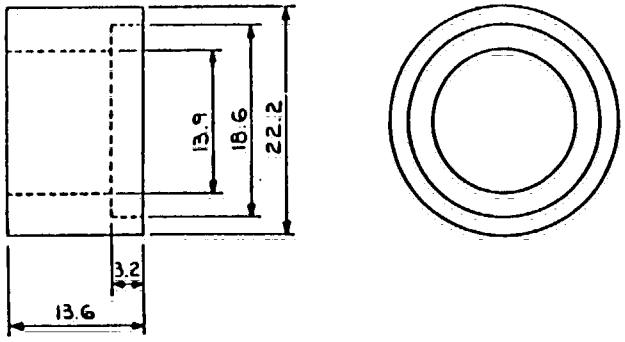
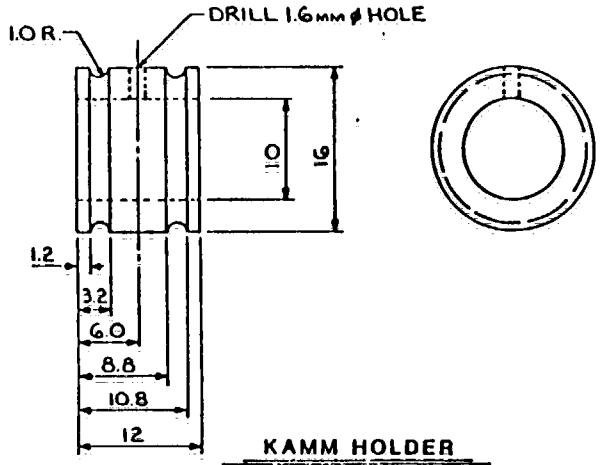
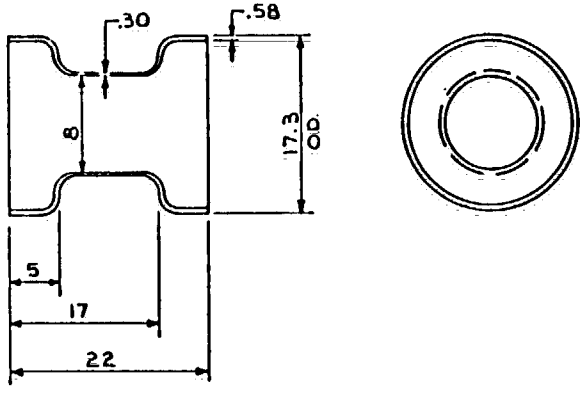


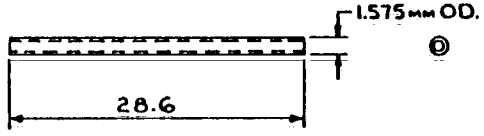
KAMM COLLAR
(CAST ACRYLIC)



KAMM HOLDER
(CAST ACRYLIC)



KAMM TUBE
(SILICONE RUBBER)



PRESSURE TUBE
(16 GA STAINLESS STEEL TUBING)

NOTE: ALL DIMENSIONS IN MM

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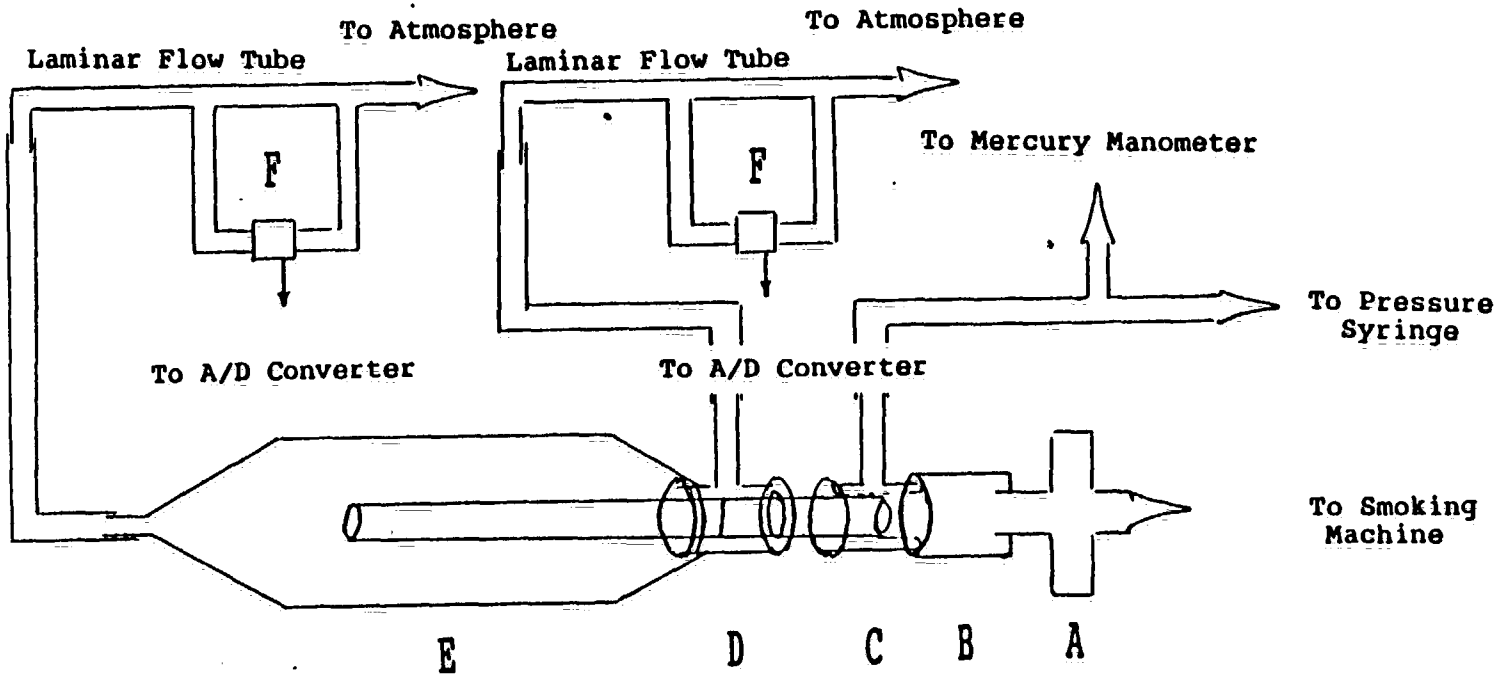
Figure 2. Pressure/Ventilation Apparatus



A. GELMAN HOLDER

B. COLLAR FOR KAMM HOLDER

C. KAMM HOLDER

D. VENTILATION ENVELOPE

E. GLASS ENVELOPE FOR CIGARETTE

F. PRESSURE TRANSDUCER

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Figure 3

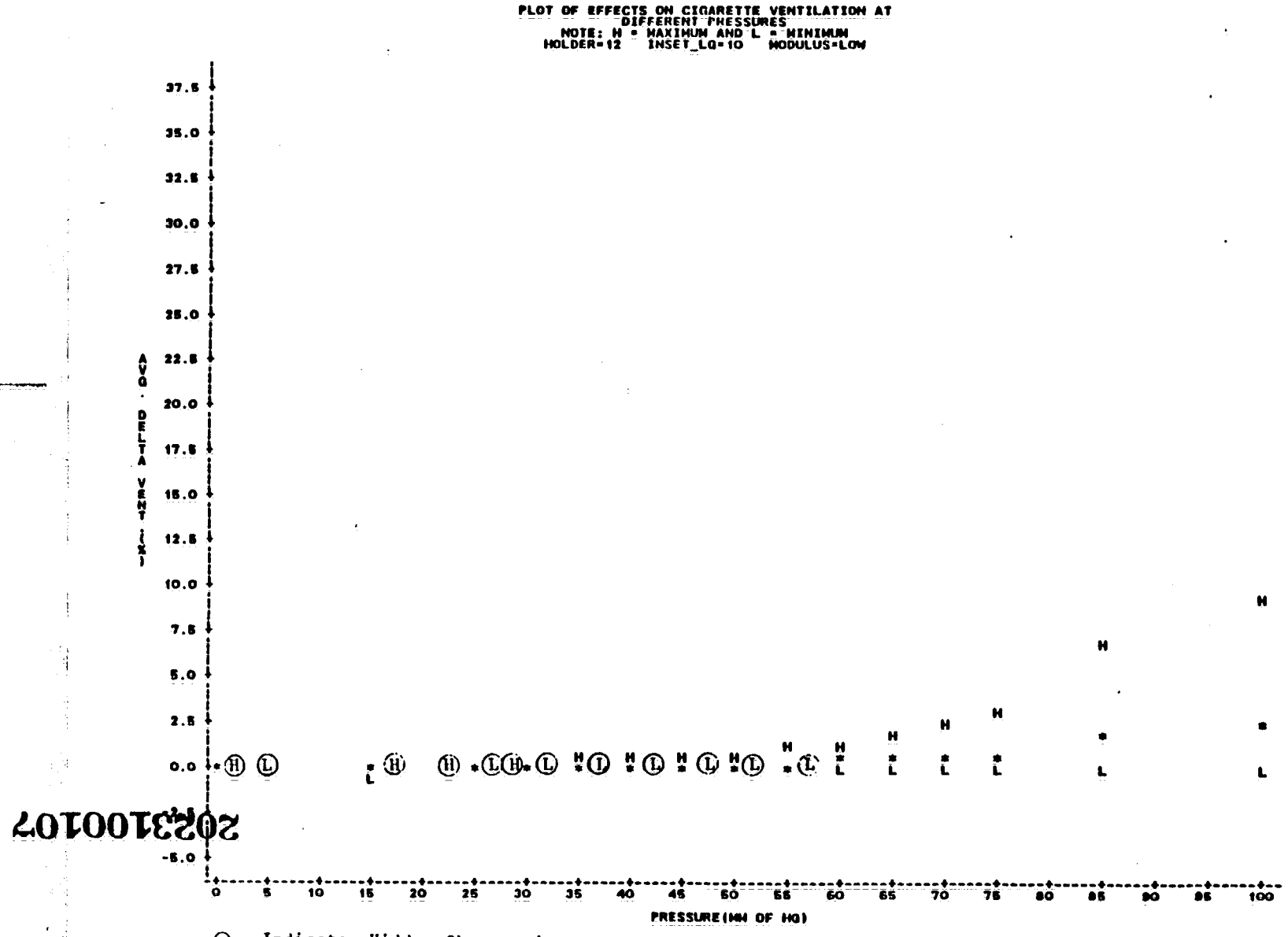

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Figure 4

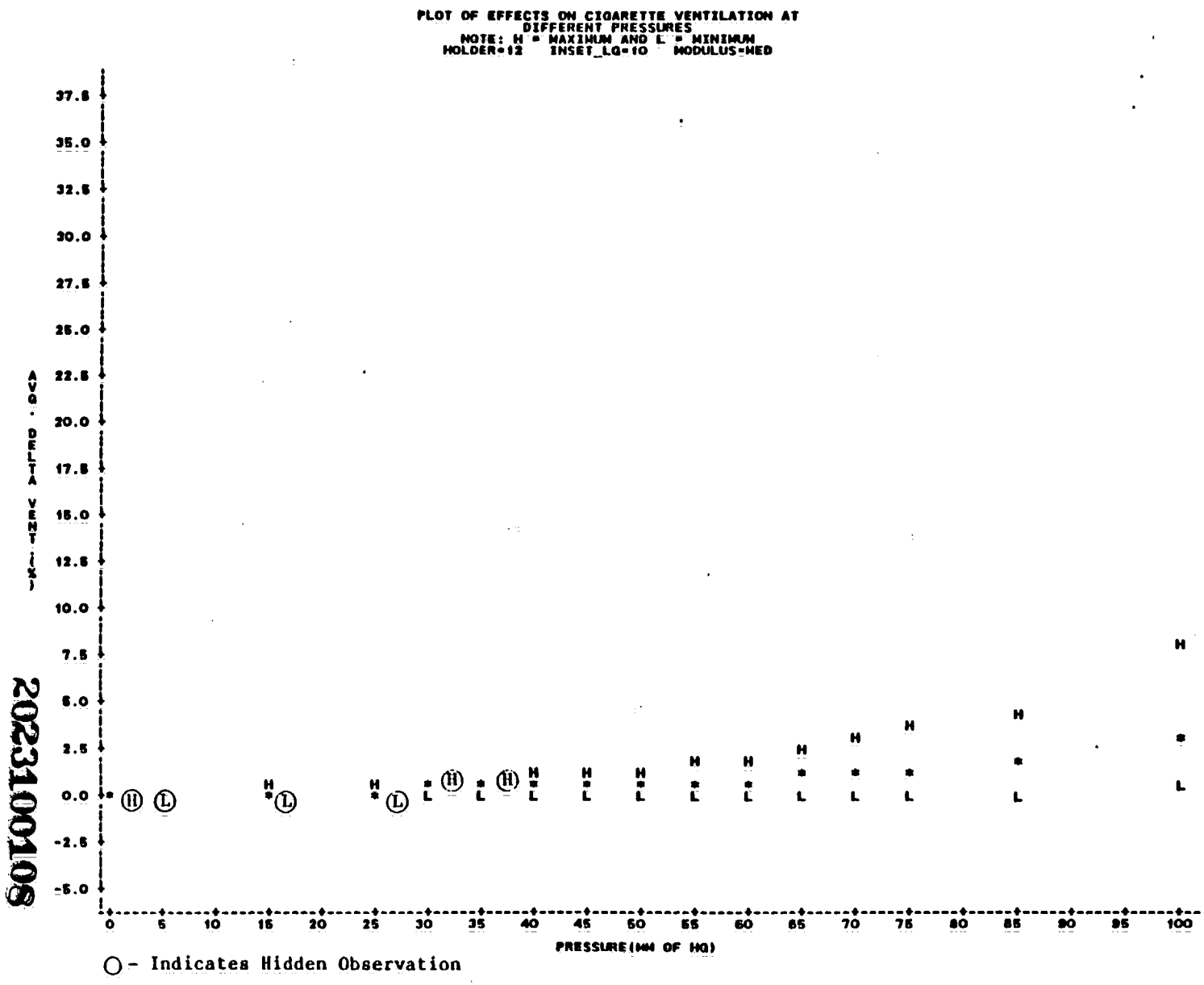

Figure 5

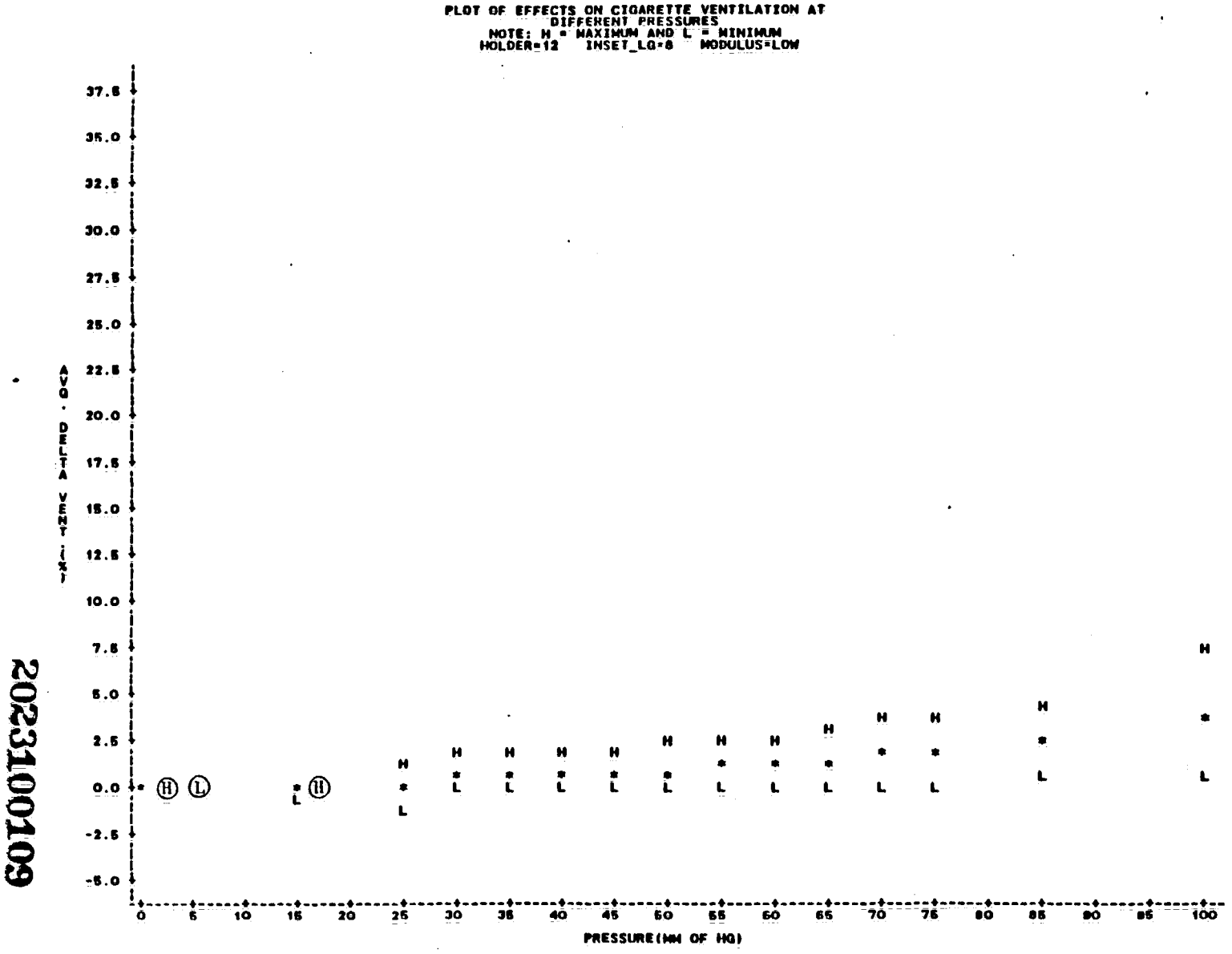

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Figure 6

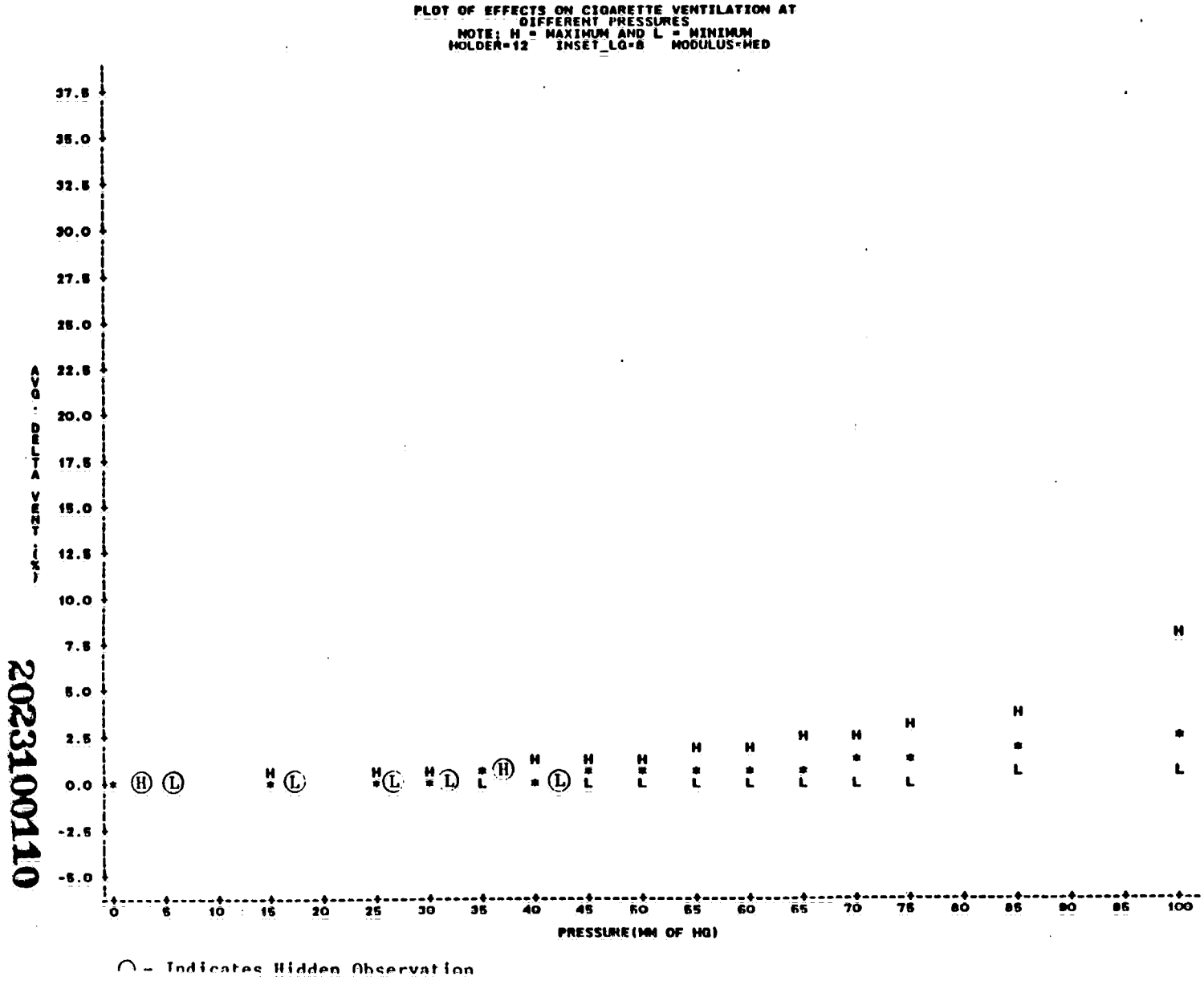

Figure 7

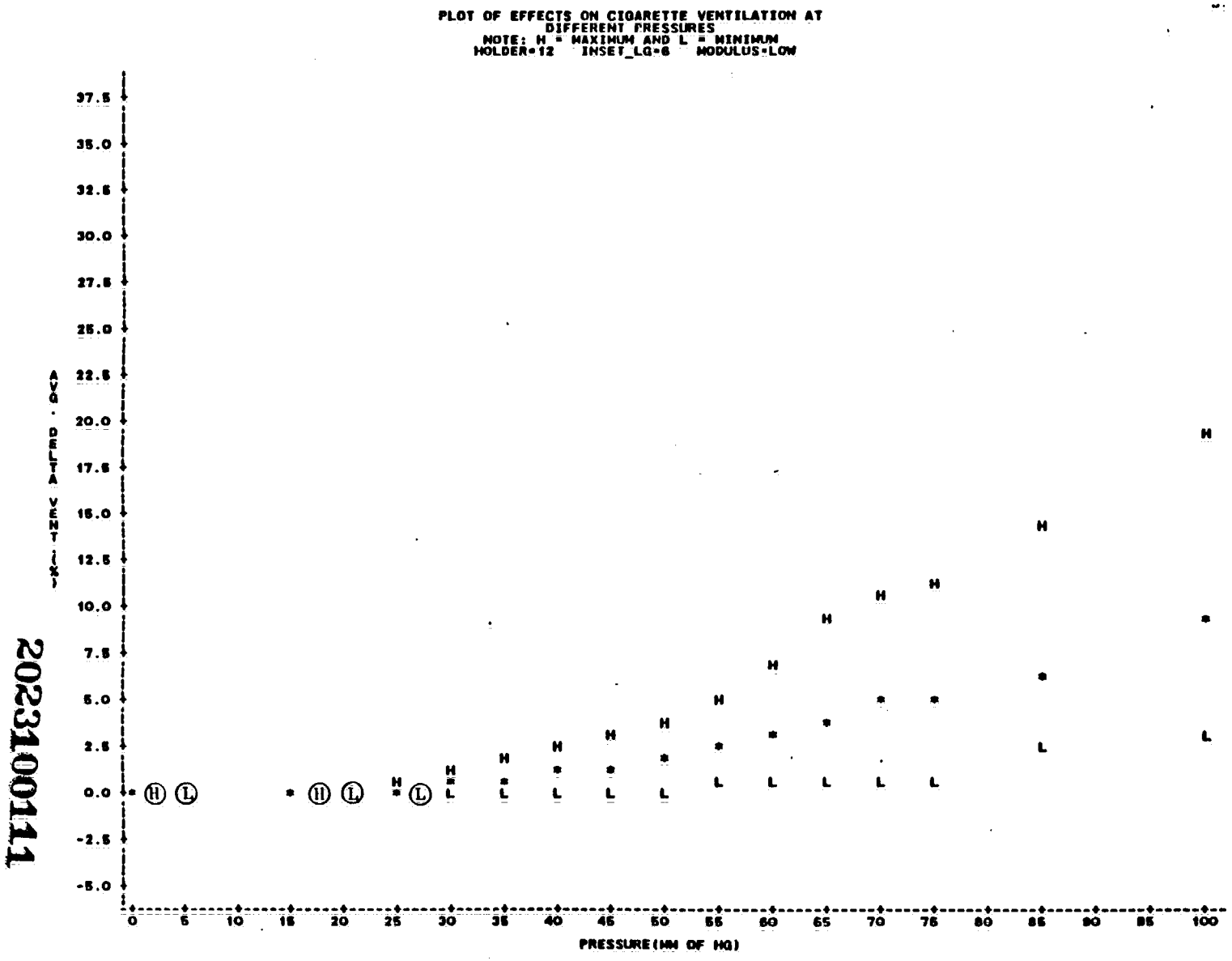

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Figure 8

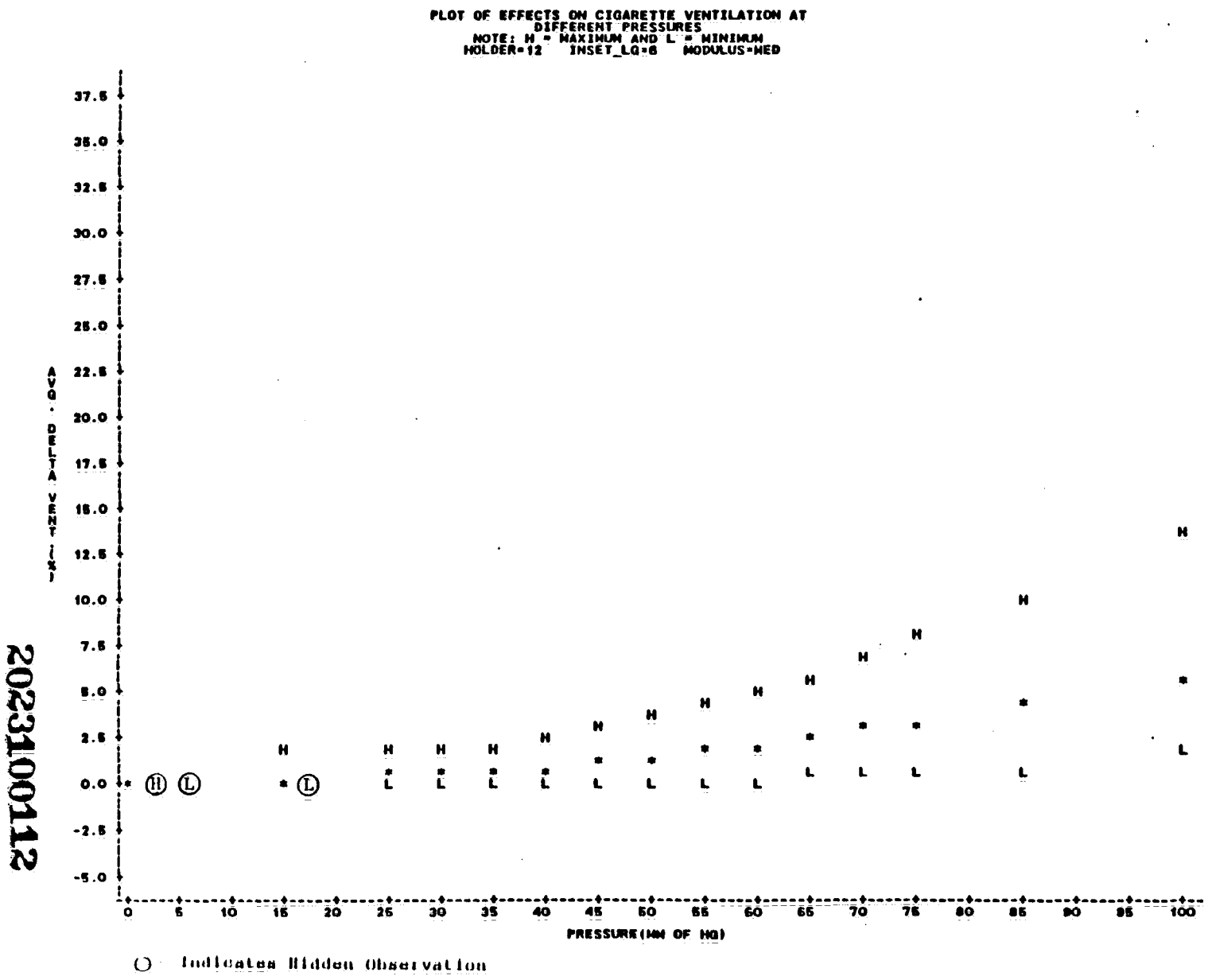

Figure 9

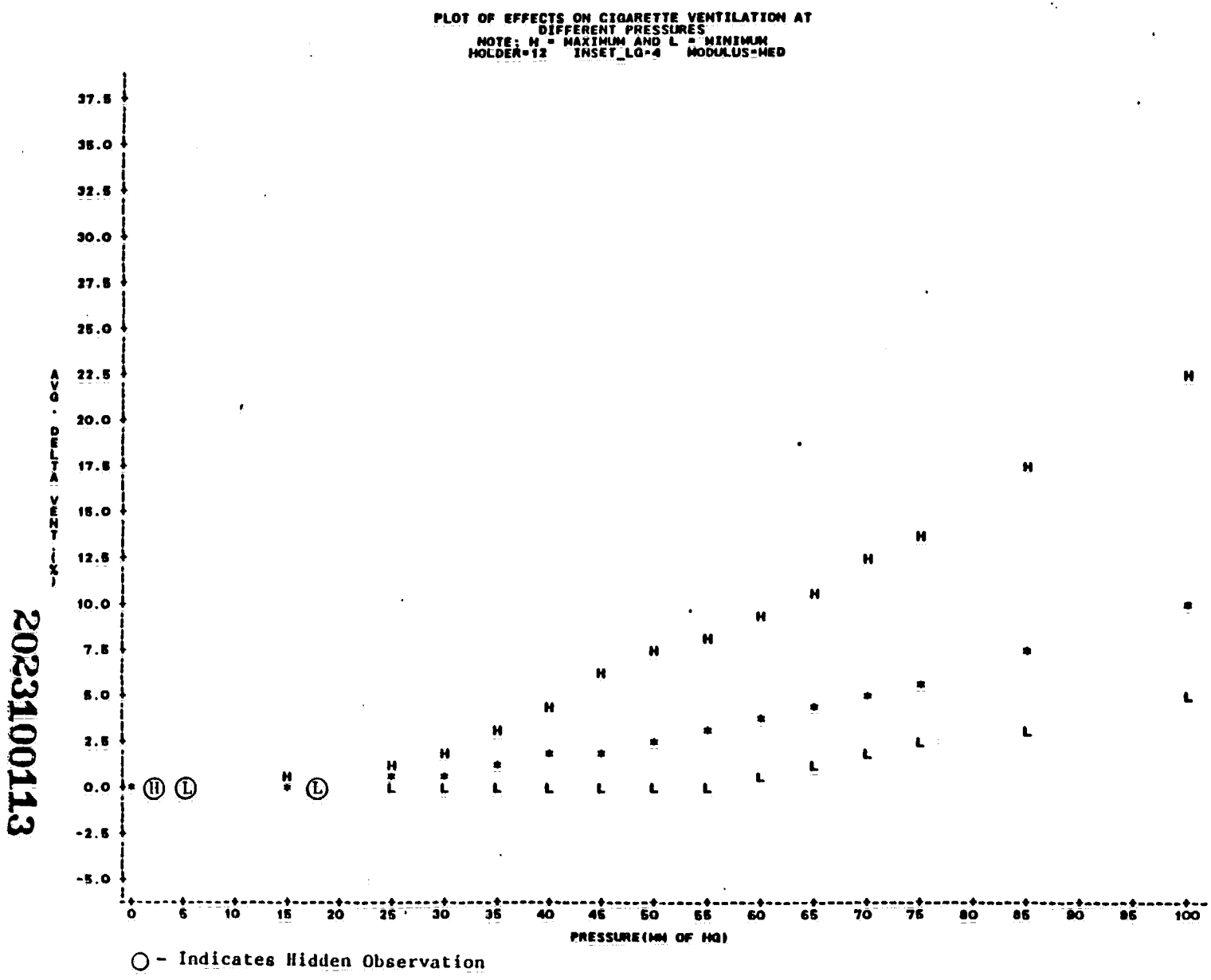

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Figure 10

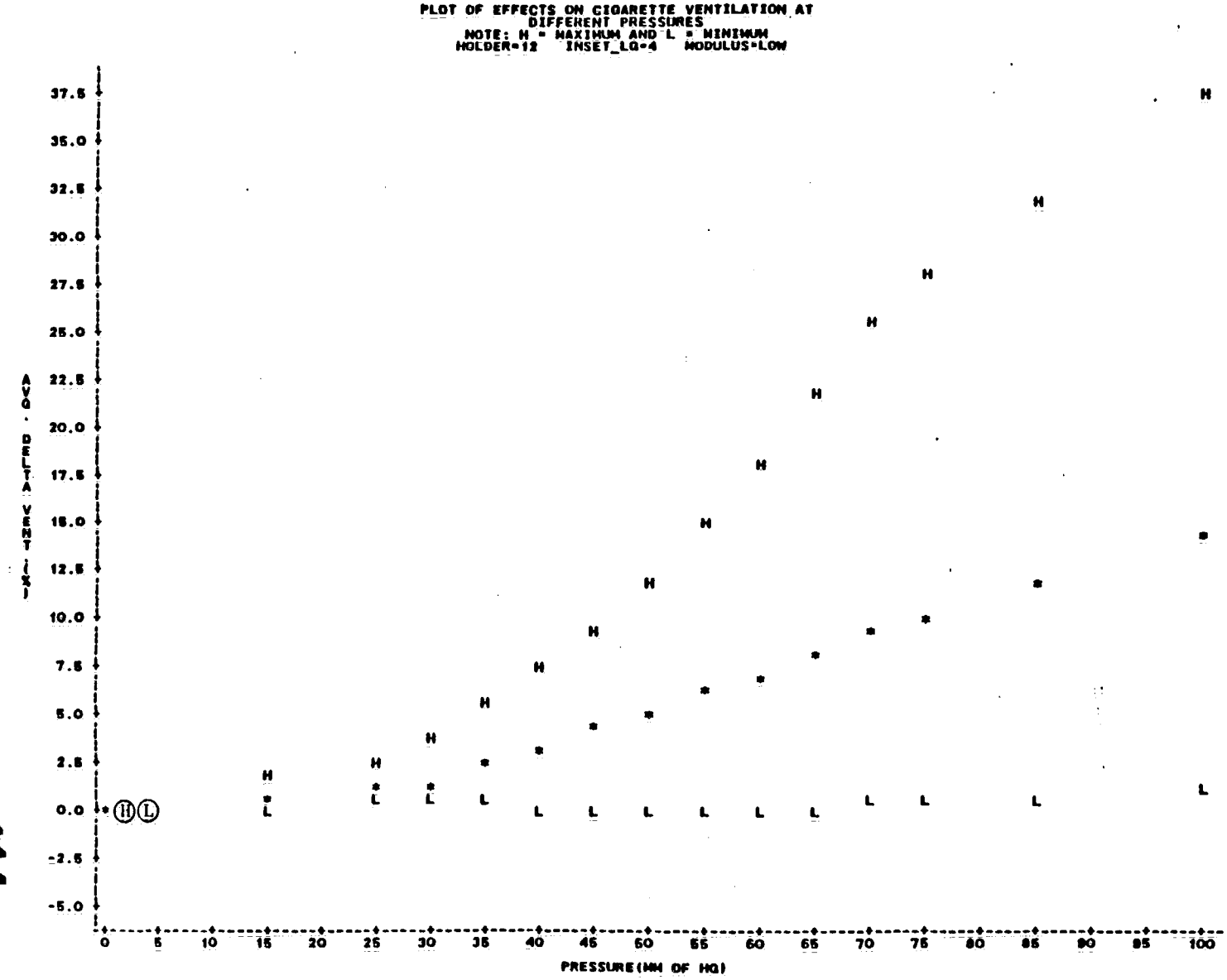

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Figure 11

PLOT OF AVERAGE EFFECTS ON CIGARETTE VENTILATION AT DIFFERENT PRESSURES AND INSERTION LENGTHS

NOTE : 1 = 10MM(12), 4 = 4MM(12), 6 = 6MM(12), 8 = 8MM(12)
WHERE ( ) IS THE HOLDER SIZE IN MM
MODULUS=LOW

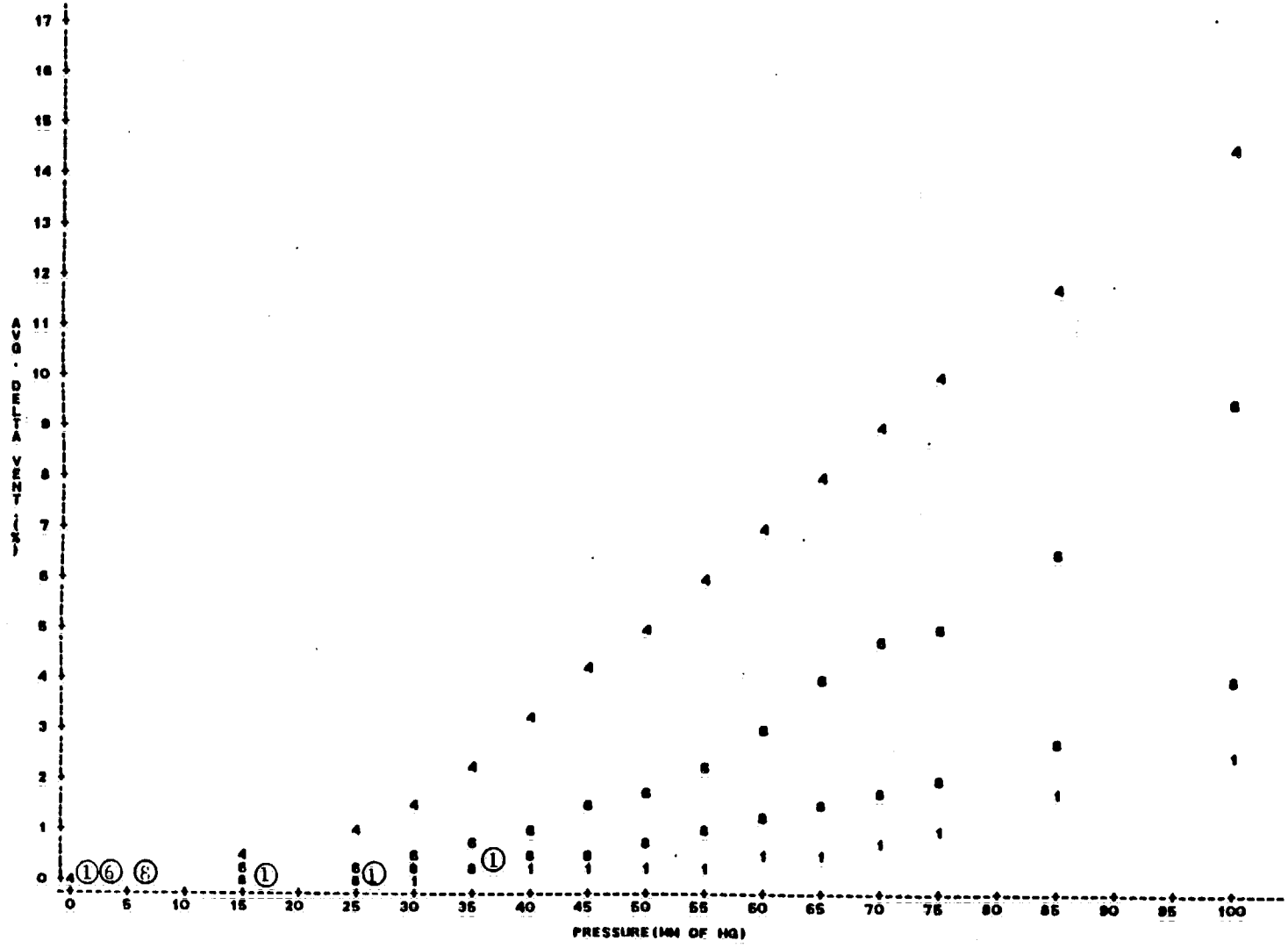

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Figure 12

PLOT OF AVERAGE EFFECTS ON CIGARETTE VENTILATION AT DIFFERENT PRESSURES AND INSERTION LENGTHS

NOTE : 1 = 10MM(12), 4 = 4MM(12), 6 = 6MM(12), 8 = 8MM(12)
WHERE ( ) IS THE HOLDER SIZE IN MM
MODULUS-MED

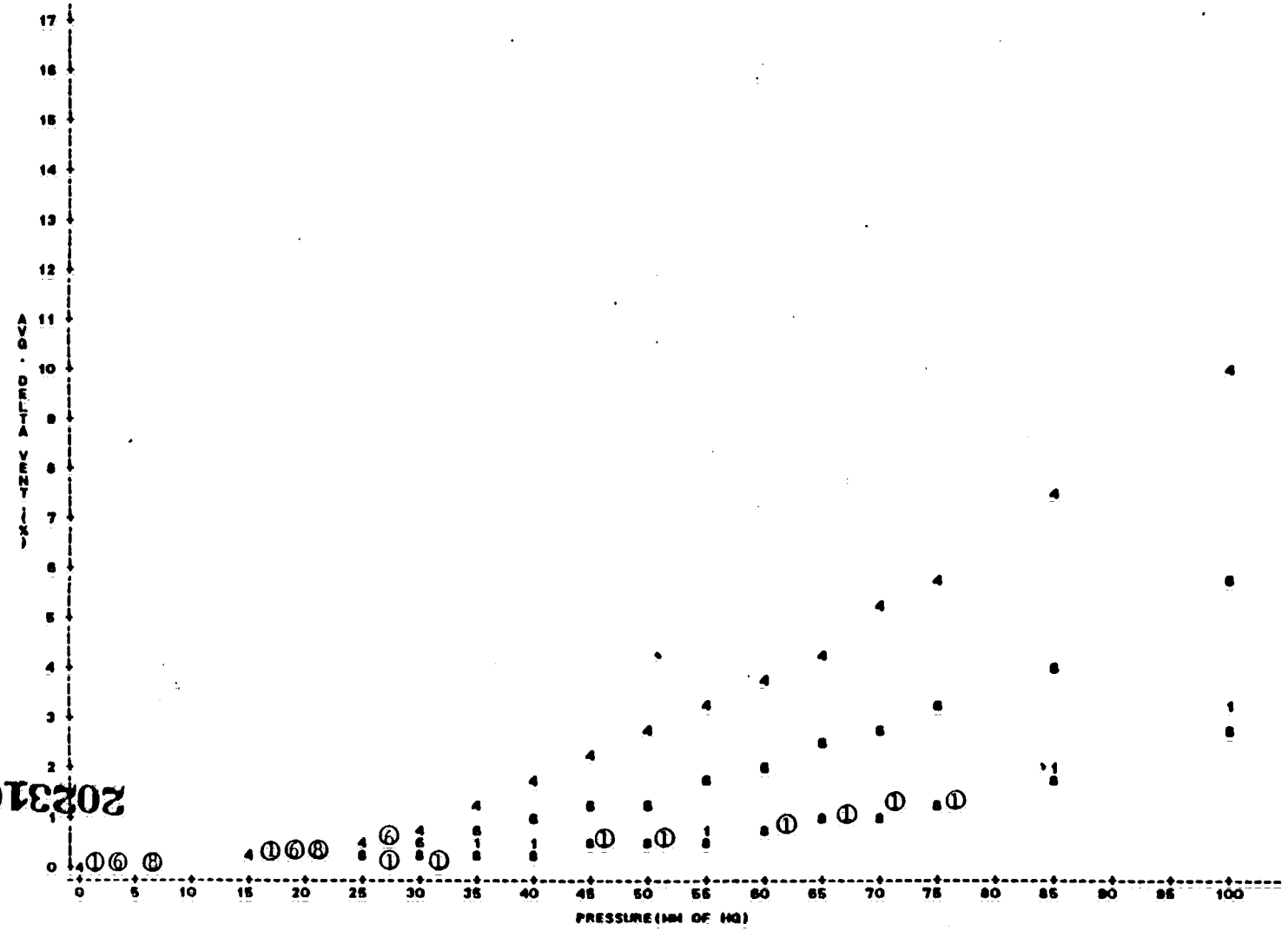

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Figure 13

Regression Analyses for Average Change in
Cigarette Ventilation (%) versus Pressure (mm of Hg)

MODEL: $Y = A + BX^2$ where Y is the average change in cigarette ventilation and X is pressure.

Modulus	Insertion Length (mm)	Coefficients		Correlation Coefficient
		A	B(X10^{-3})	r^2
Low	4	0.737797	1.535284	0.97
	6	-0.376379	0.9767059	0.99
	8	-0.162277	0.4009607	0.99
	10	-0.252144	0.2407161	0.92
Medium	4	0.038224	1.017139	0.99
	6	0.012829	0.5707385	0.99
	8	-0.054039	0.2507447	0.97
	10	-0.048470	0.2827123	0.96

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Figure 14

Initial Smoke Deliveries for BARCLAY KS
Nonmenthol Samples

Measurements	$\bar{x}$	s	n
Tar (mg/cig.)	0.3	0.1	7
Nicotine (mg/cig.)	0.07	0.03	9
CO (mg/cig.)	0.5	0.1	19
Puffs (/cig.)	8.5	0.3	19

Figure 15

SUMMARY STATISTICS FOR SMOKE DELIVERIES BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=TAR(MG/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		0.93	0.38	54.00
MEDIUM		0.83	0.37	54.00
	INSERTION LENGTH			
MEAN	4MM	0.98	0.47	36.00
	6MM	0.81	0.36	36.00
	8MM	0.74	0.22	36.00
	PRESSURE(MM OF HG)			
MEAN	35MM	0.69	0.17	36.00
	60MM	0.72	0.28	36.00
	85MM	1.22	0.38	36.00
MEAN		0.88	0.38	108.00

VARIABLE=NICOTINE(MG/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		0.12	0.05	54.00
MEDIUM		0.10	0.04	54.00
	INSERTION LENGTH			
MEAN	4MM	0.12	0.05	36.00
	6MM	0.11	0.05	36.00
	8MM	0.09	0.03	36.00
	PRESSURE(MM OF HG)			
MEAN	35MM	0.08	0.02	36.00
	60MM	0.10	0.03	36.00
	85MM	0.15	0.04	36.00
MEAN		0.11	0.04	108.00

Figure 16

SUMMARY STATISTICS FOR SMOKE DELIVERIES BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=CO(MG/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		0.51	0.36	108.00
MEDIUM		0.48	0.28	107.00
	INSERTION LENGTH			
MEAN	4MM	0.56	0.40	72.00
	6MM	0.50	0.32	72.00
	8MM	0.43	0.22	71.00
	PRESSURE(MM OF HG)			
MEAN	35MM	0.32	0.14	72.00
	50MM	0.45	0.24	71.00
	85MM	0.71	0.40	72.00
MEAN		0.48	0.32	215.00

VARIABLE=FILTER_NICOTINE(MG/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		0.34	0.07	54.00
MEDIUM		0.34	0.06	54.00
	INSERTION LENGTH			
MEAN	4MM	0.36	0.08	36.00
	6MM	0.35	0.06	36.00
	8MM	0.32	0.05	36.00
	PRESSURE(MM OF HG)			
MEAN	35MM	0.29	0.04	36.00
	60MM	0.34	0.06	36.00
	85MM	0.39	0.06	36.00
MEAN		0.34	0.06	108.00

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Figure 17

SUMMARY STATISTICS FOR SMOKE DELIVERIES BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=FILTER_EFFICIENCY(%)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		76.20	4.05	54.00
MEDIUM		77.41	4.42	54.00
	INSERTION LENGTH			
MEAN	4MM	74.88	3.60	36.00
	6MM	78.36	5.25	36.00
	8MM	77.68	3.69	36.00
	PRESSURE(MM OF HG)			
MEAN	35MM	78.47	3.39	36.00
	50MM	77.66	3.90	36.00
	85MM	72.89	3.61	36.00
MEAN		76.31	4.36	108.00

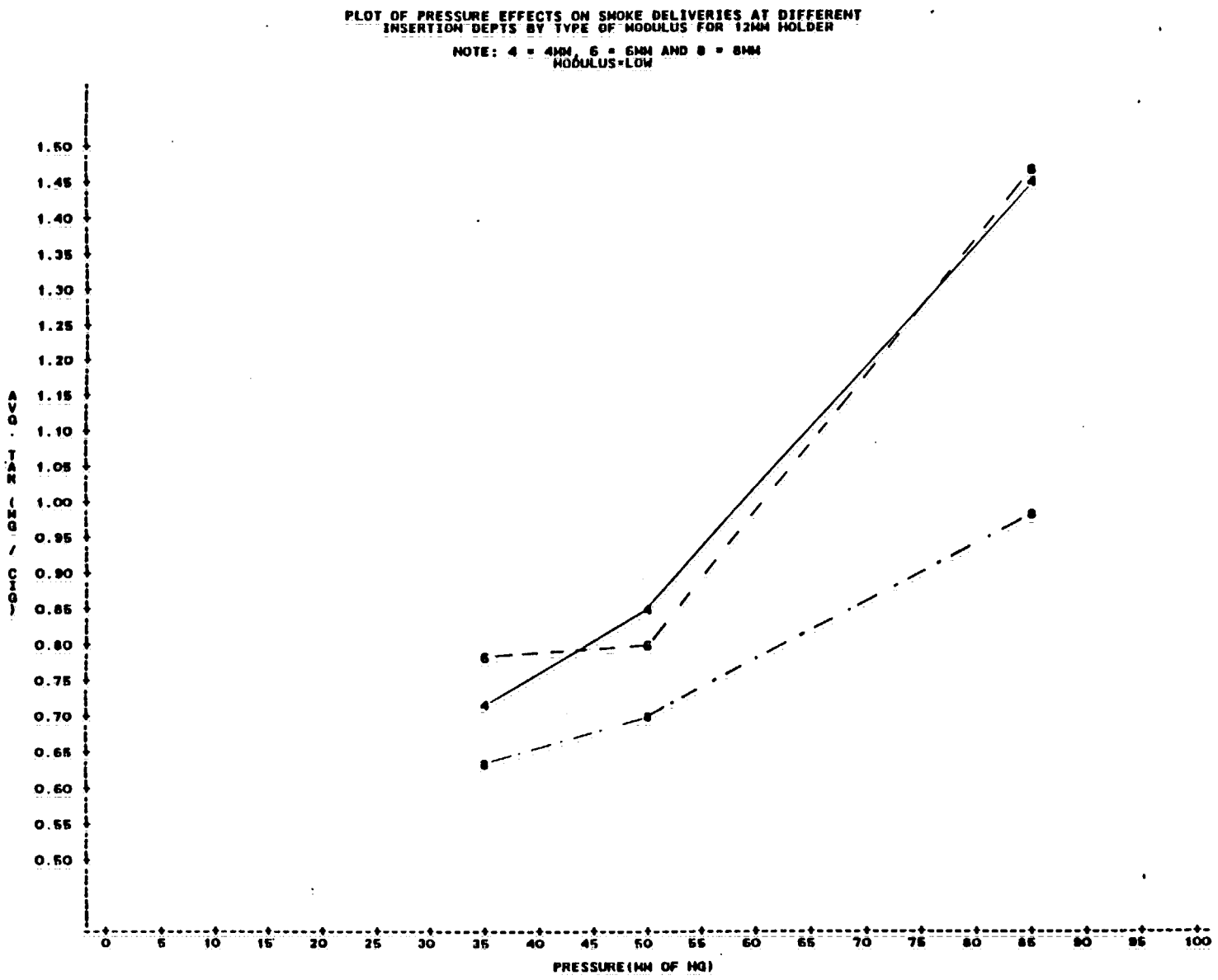
VARIABLE=H2O(MG/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		0.17	0.06	54.00
MEDIUM		0.18	0.05	54.00
	INSERTION LENGTH			
MEAN	4MM	0.18	0.05	36.00
	6MM	0.17	0.07	36.00
	8MM	0.16	0.05	36.00
	PRESSURE(MM OF HG)			
MEAN	35MM	0.15	0.05	36.00
	50MM	0.19	0.06	36.00
	85MM	0.18	0.06	36.00
MEAN		0.17	0.06	108.00

VARIABLE=PUFF(/CIG)

		RESULT		
		MEAN	STD	N
MODULUS				
LOW		8.29	0.34	108.00
MEDIUM		8.24	0.39	108.00
	INSERTION LENGTH			
MEAN	4MM	8.19	0.37	72.00
	6MM	8.30	0.30	72.00
	8MM	8.31	0.42	72.00
	PRESSURE(MM OF HG)			
MEAN	35MM	8.24	0.34	72.00
	50MM	8.28	0.36	72.00
	85MM	8.28	0.41	72.00
MEAN		8.27	0.37	216.00

Figure 18



2023100122

Figure 19

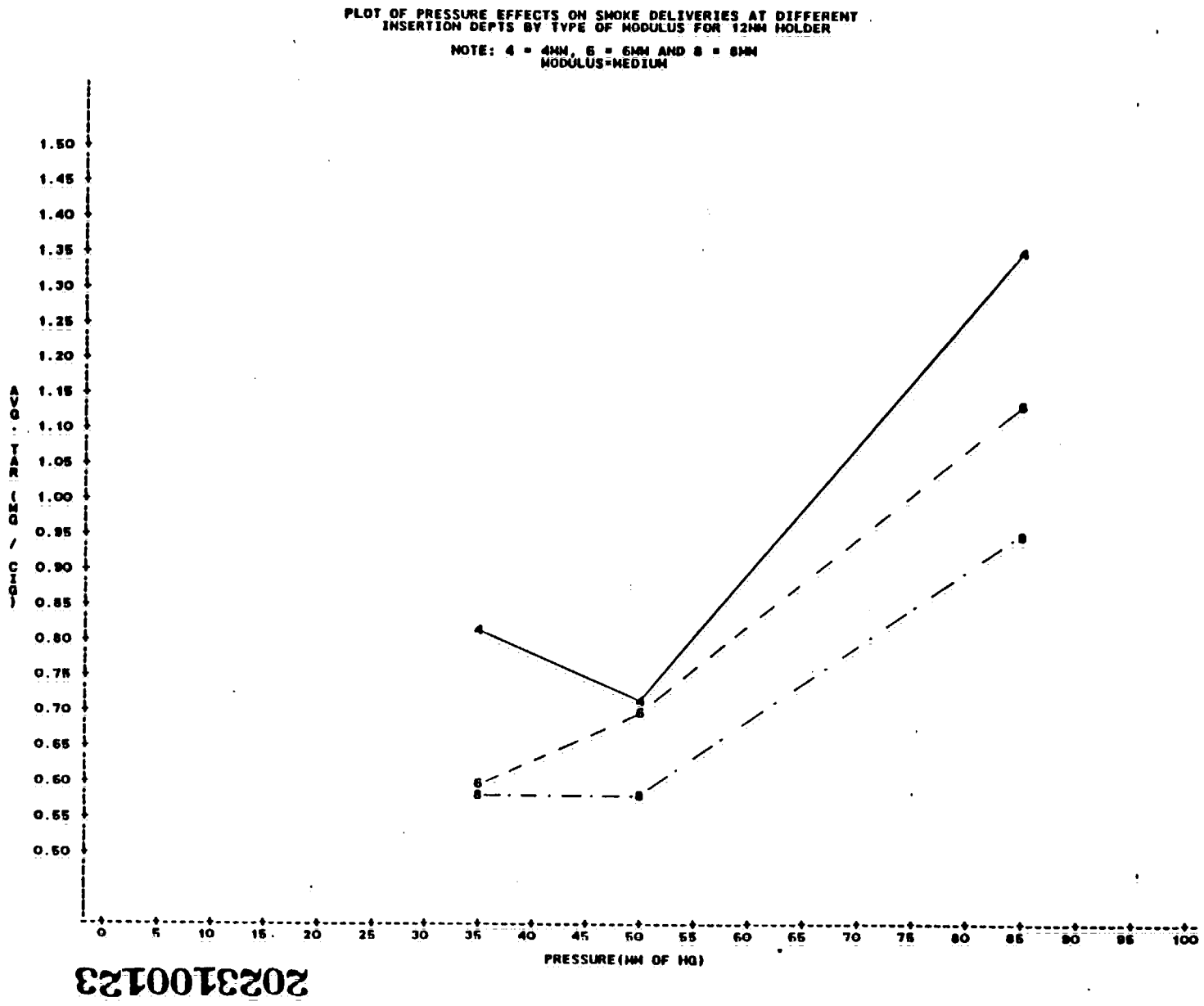


Figure 20

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=LOW

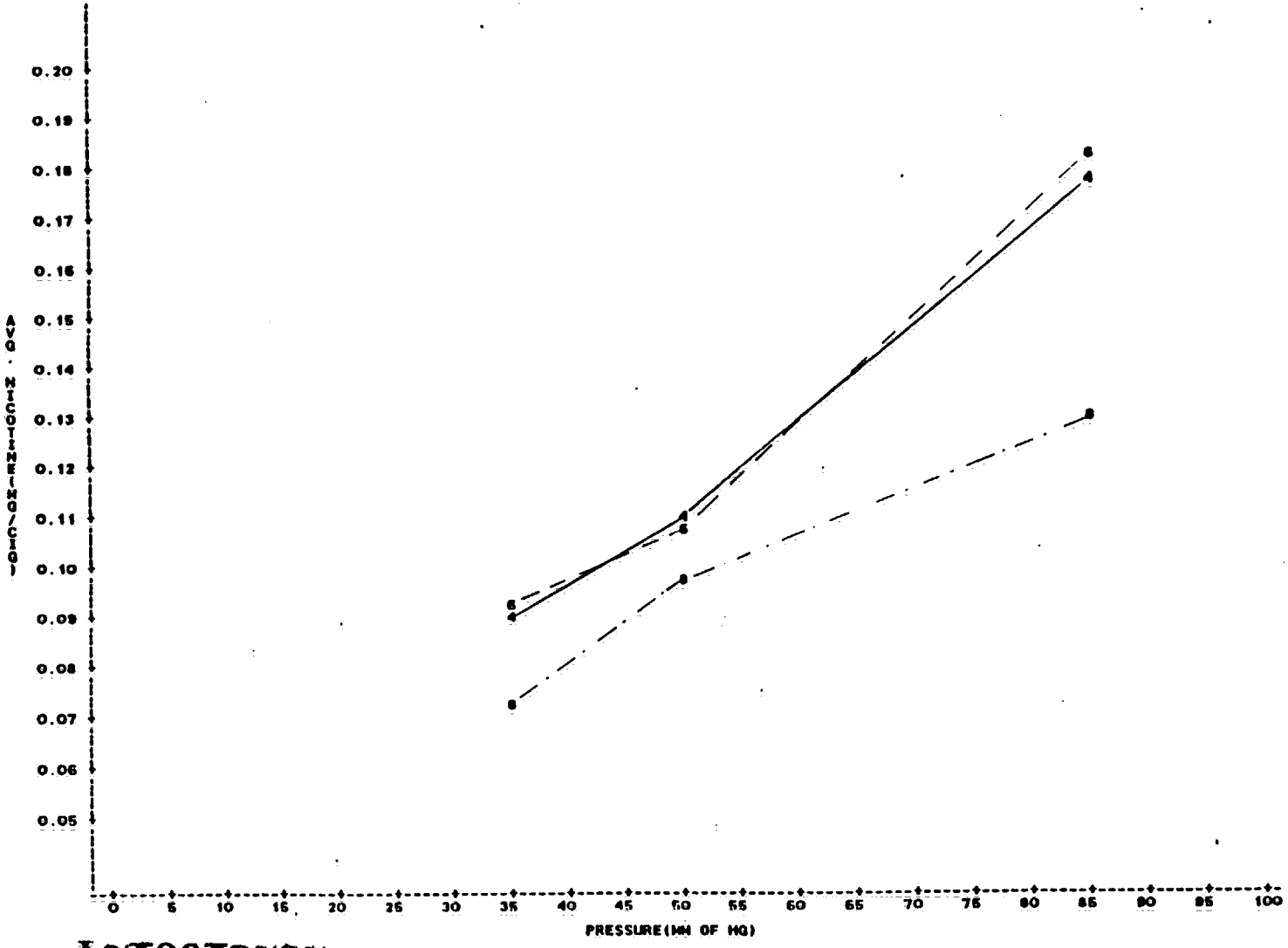
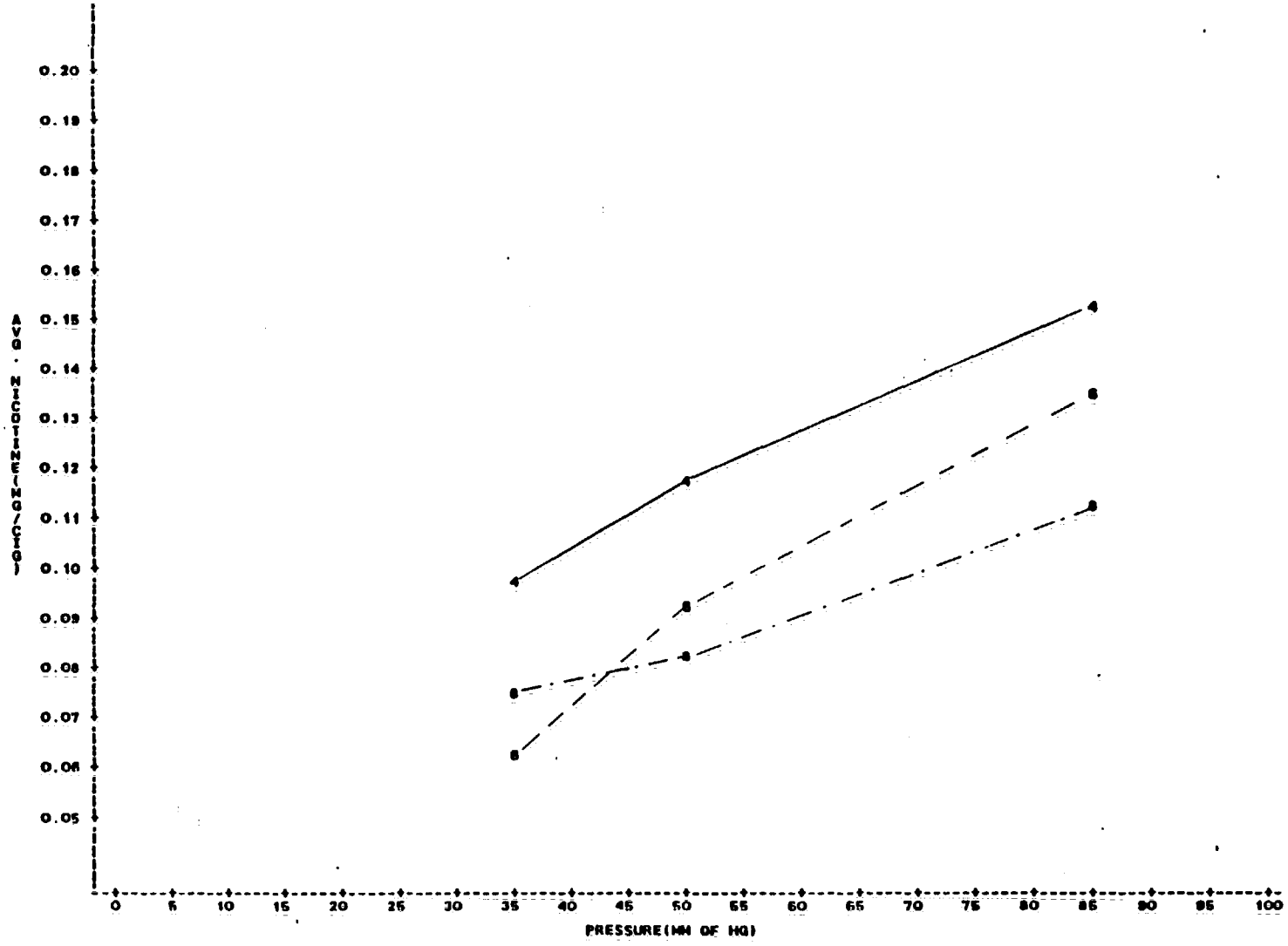


Figure 21

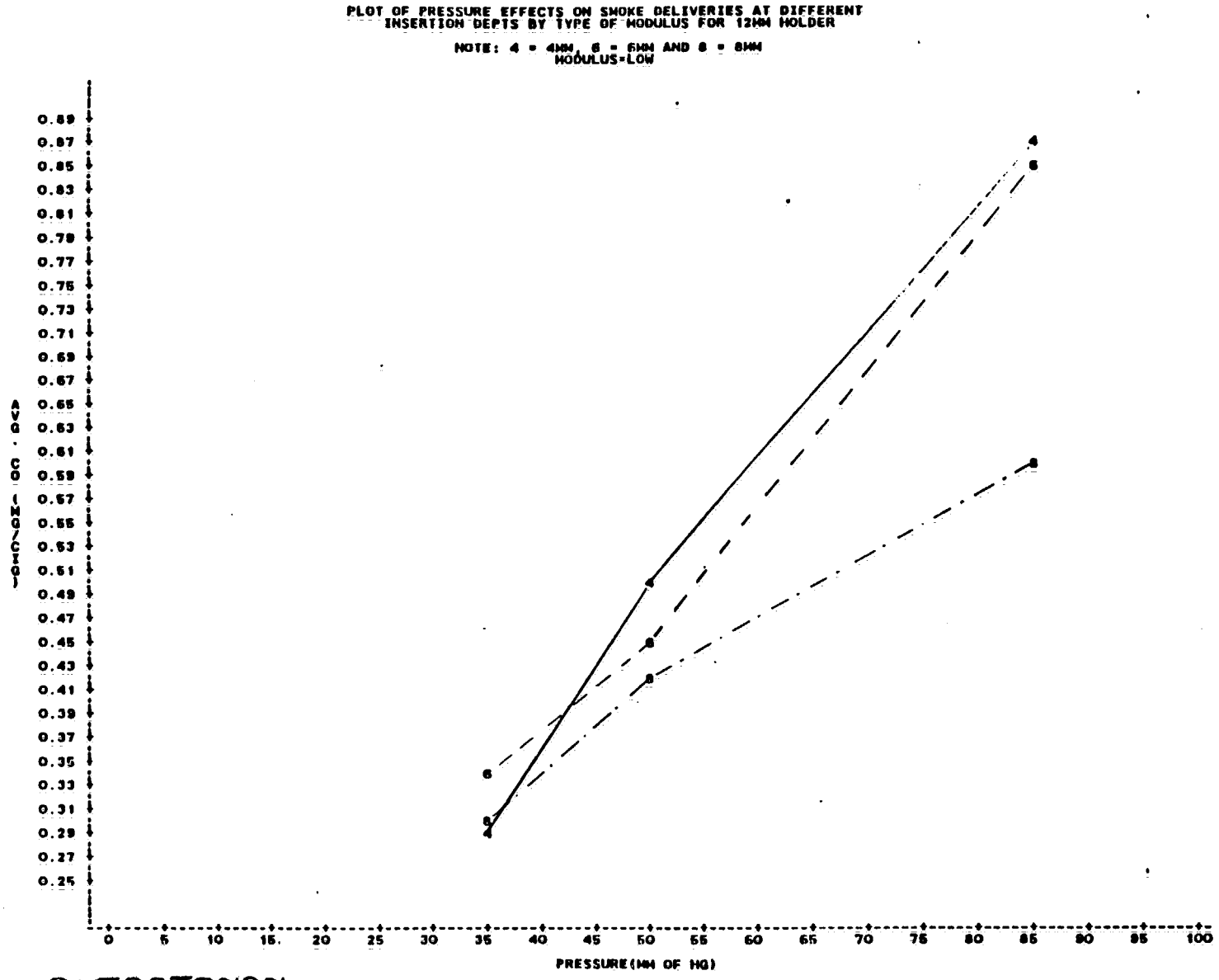
PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=MEDIUM



2023100125

Figure 22



2023100126

Figure 23

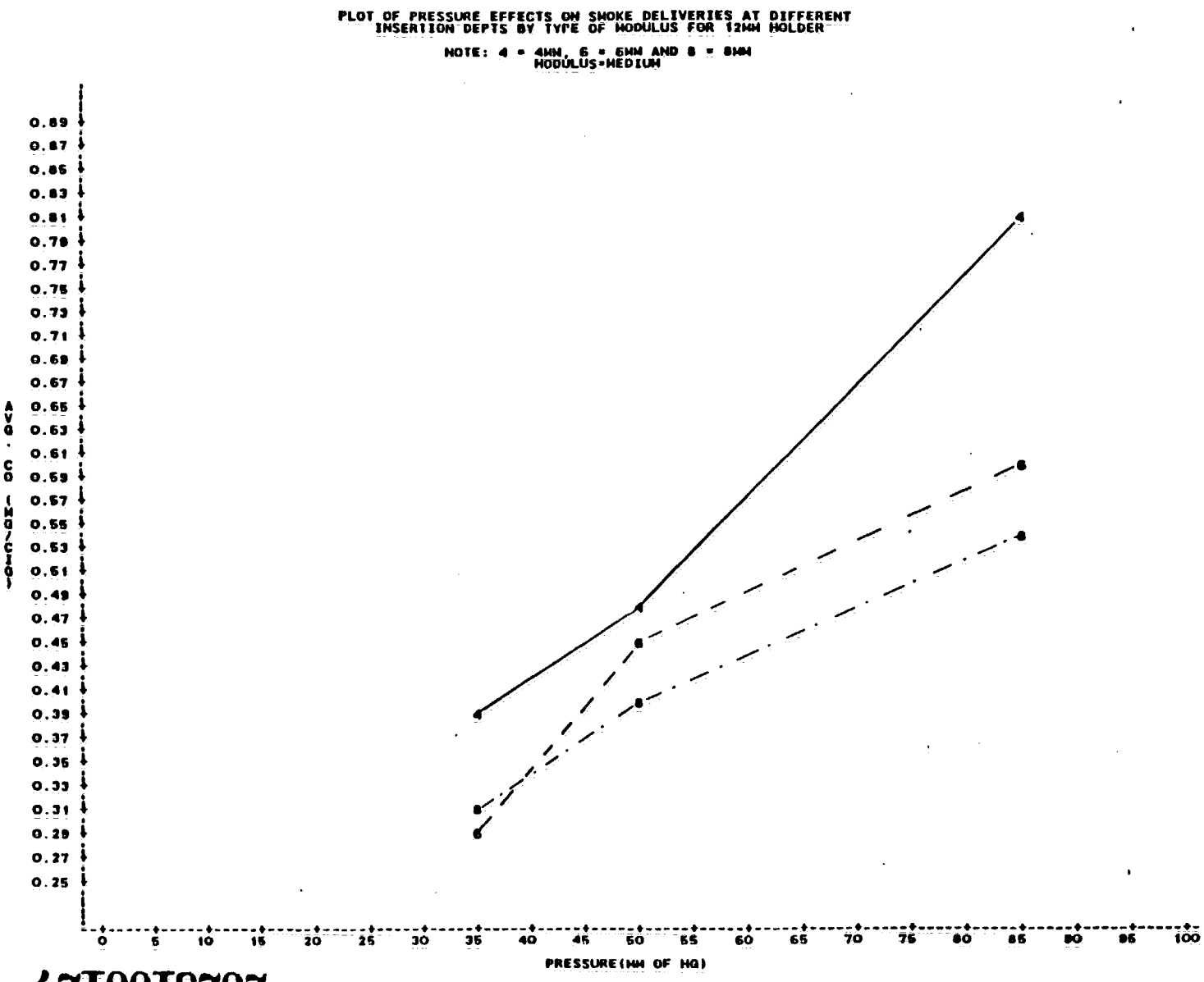


Figure 24

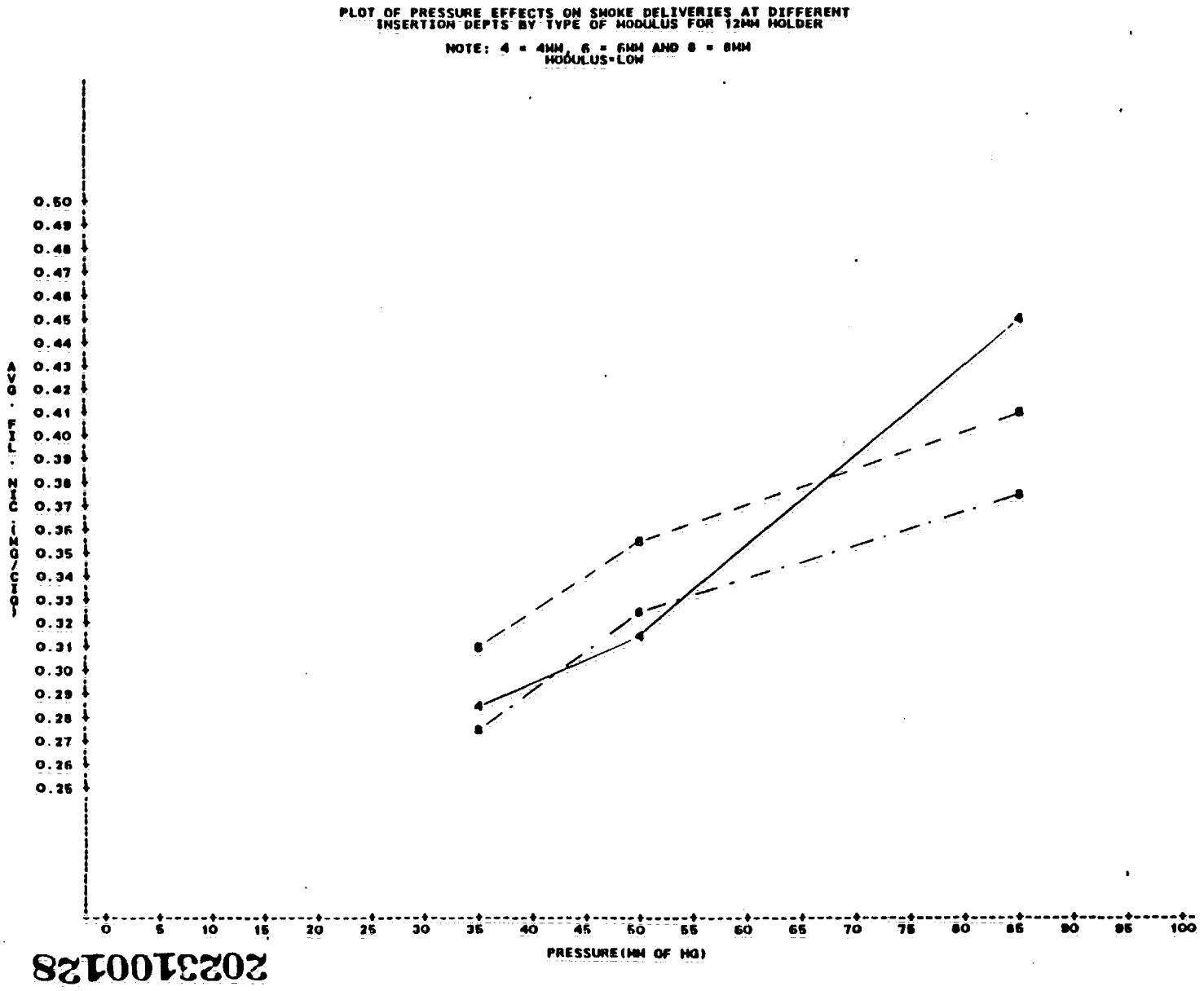
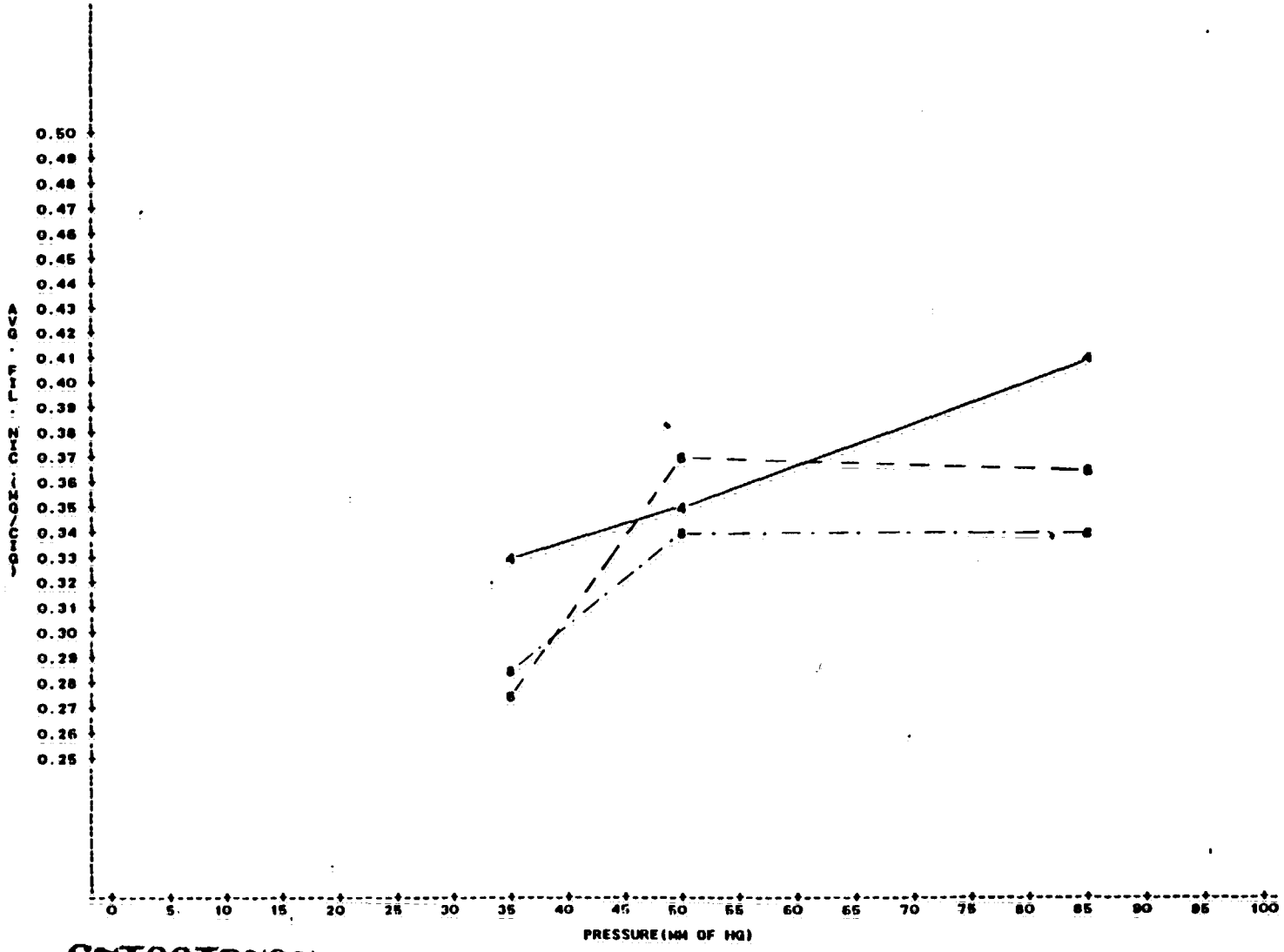


Figure 25

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS-MEDIUM

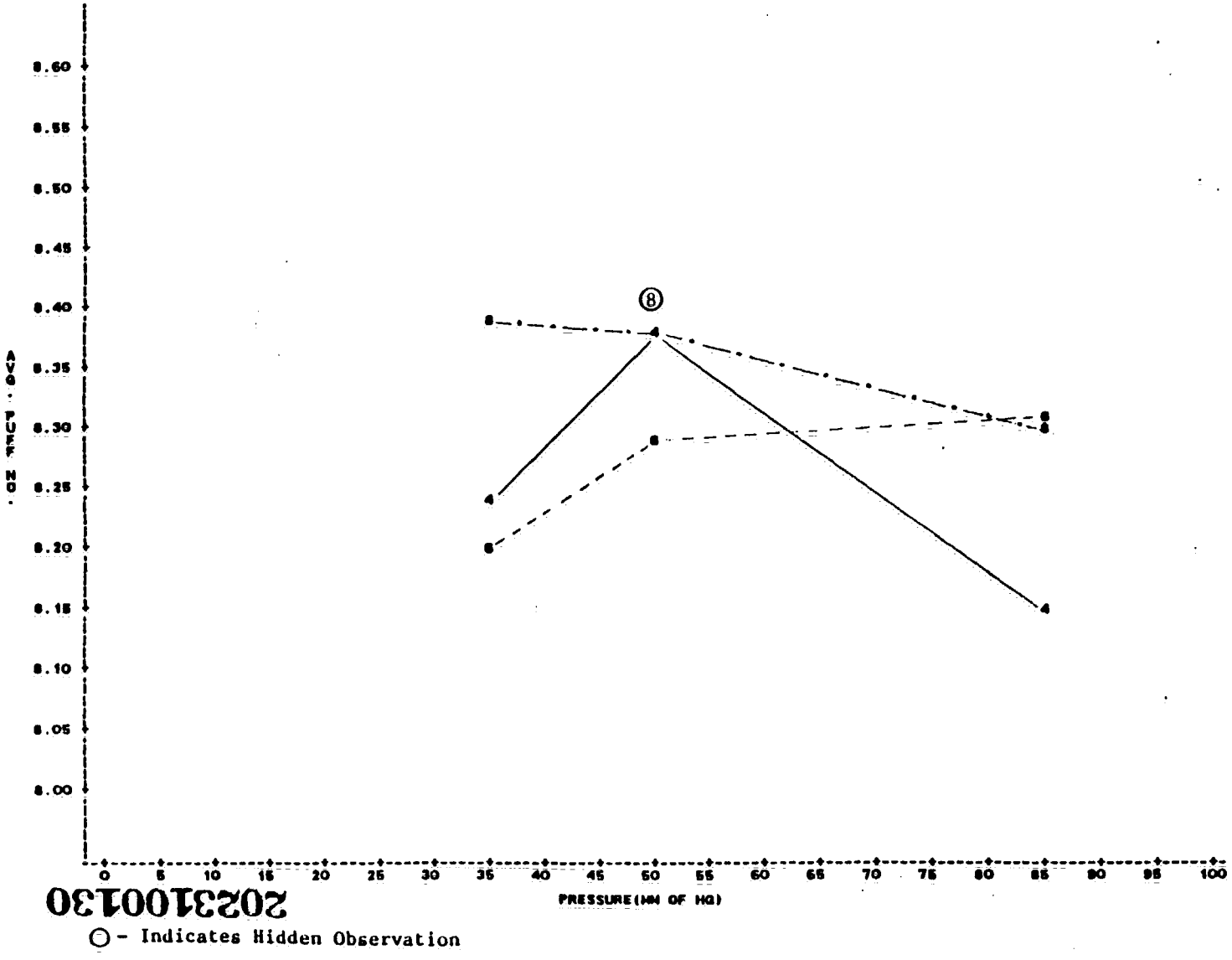


2023100129

Figure 26

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=LOW



○ - Indicates Hidden Observation

Figure 27

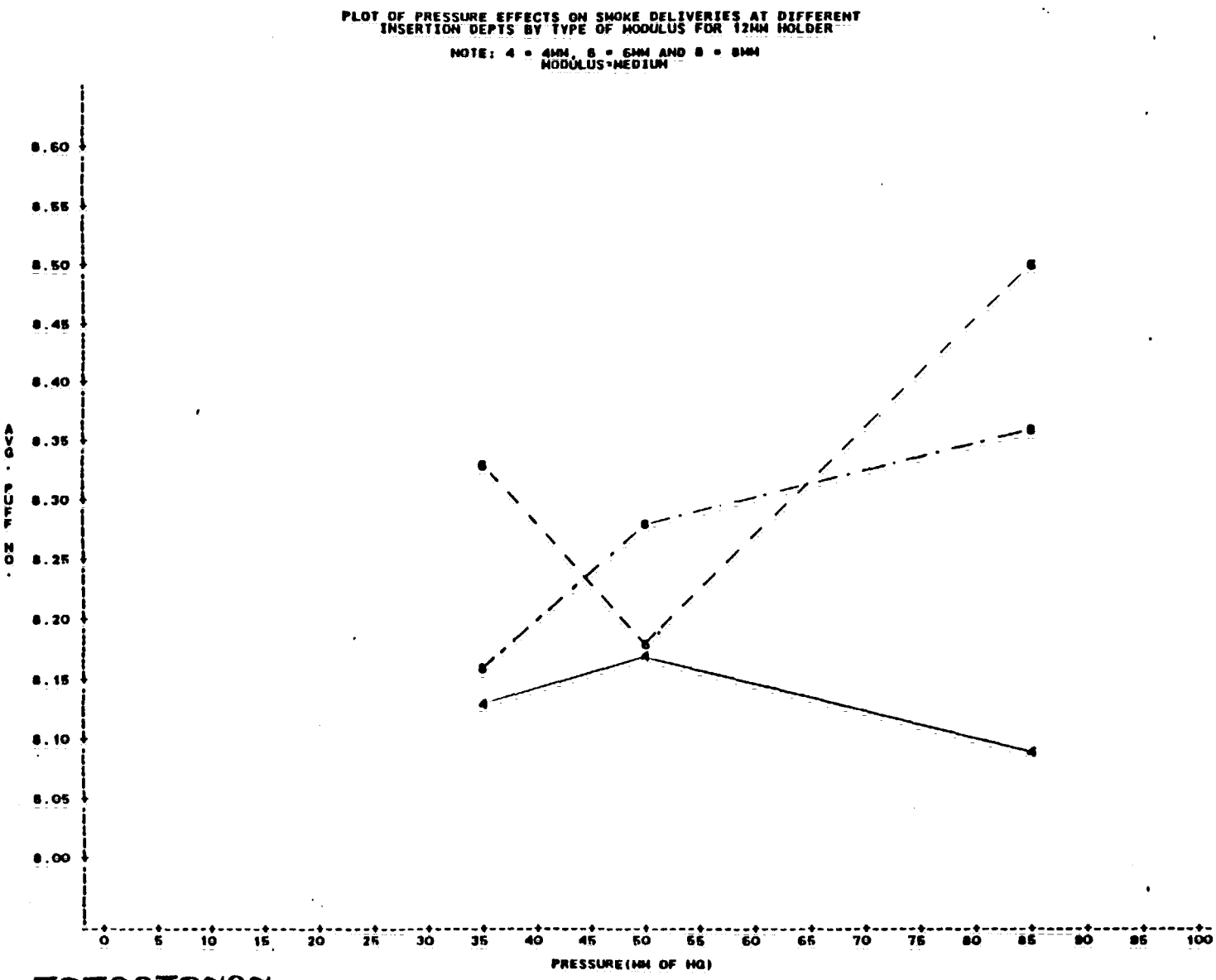


Figure 28

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=LOW

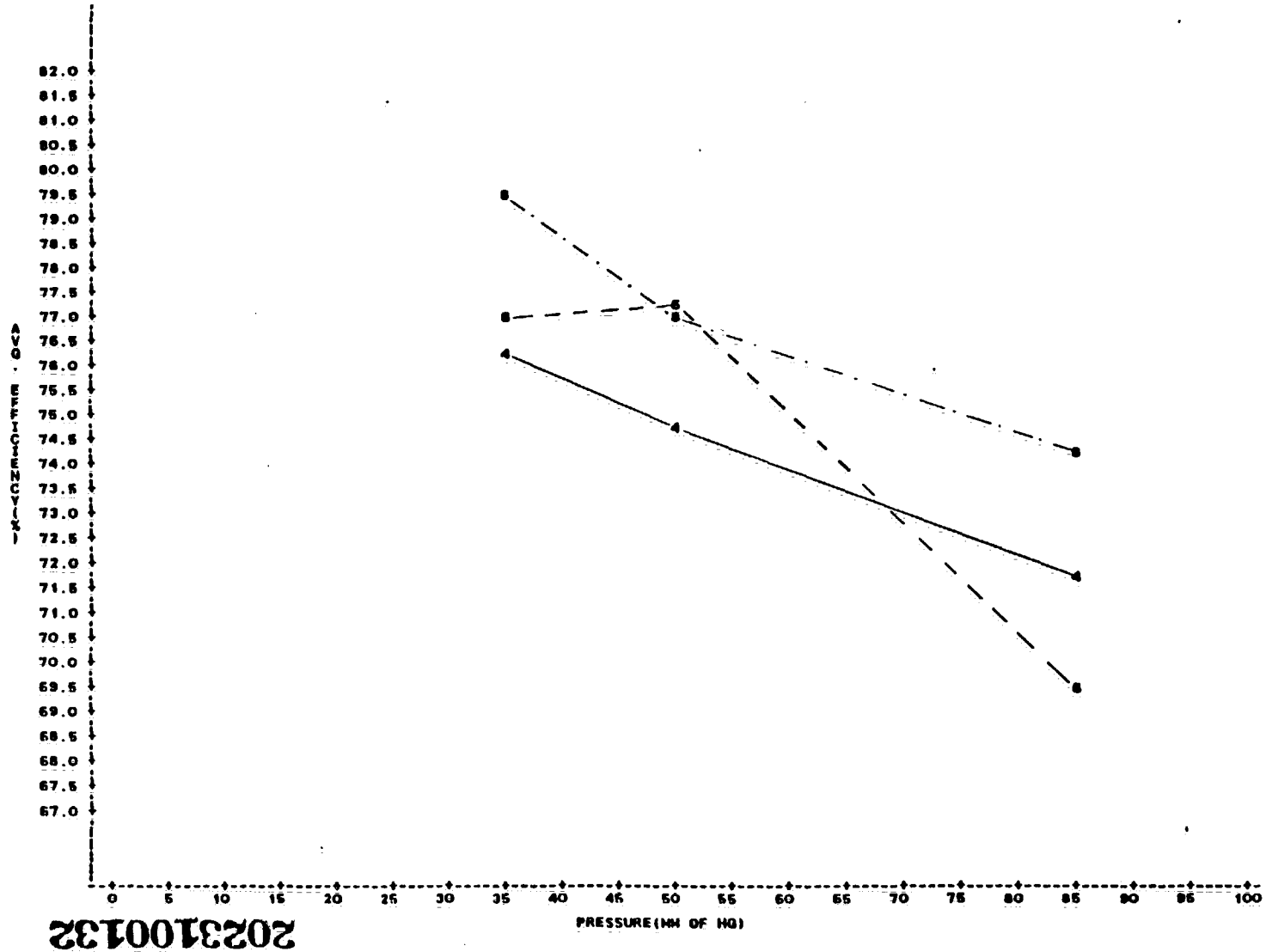


Figure 29

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=MEDIUM

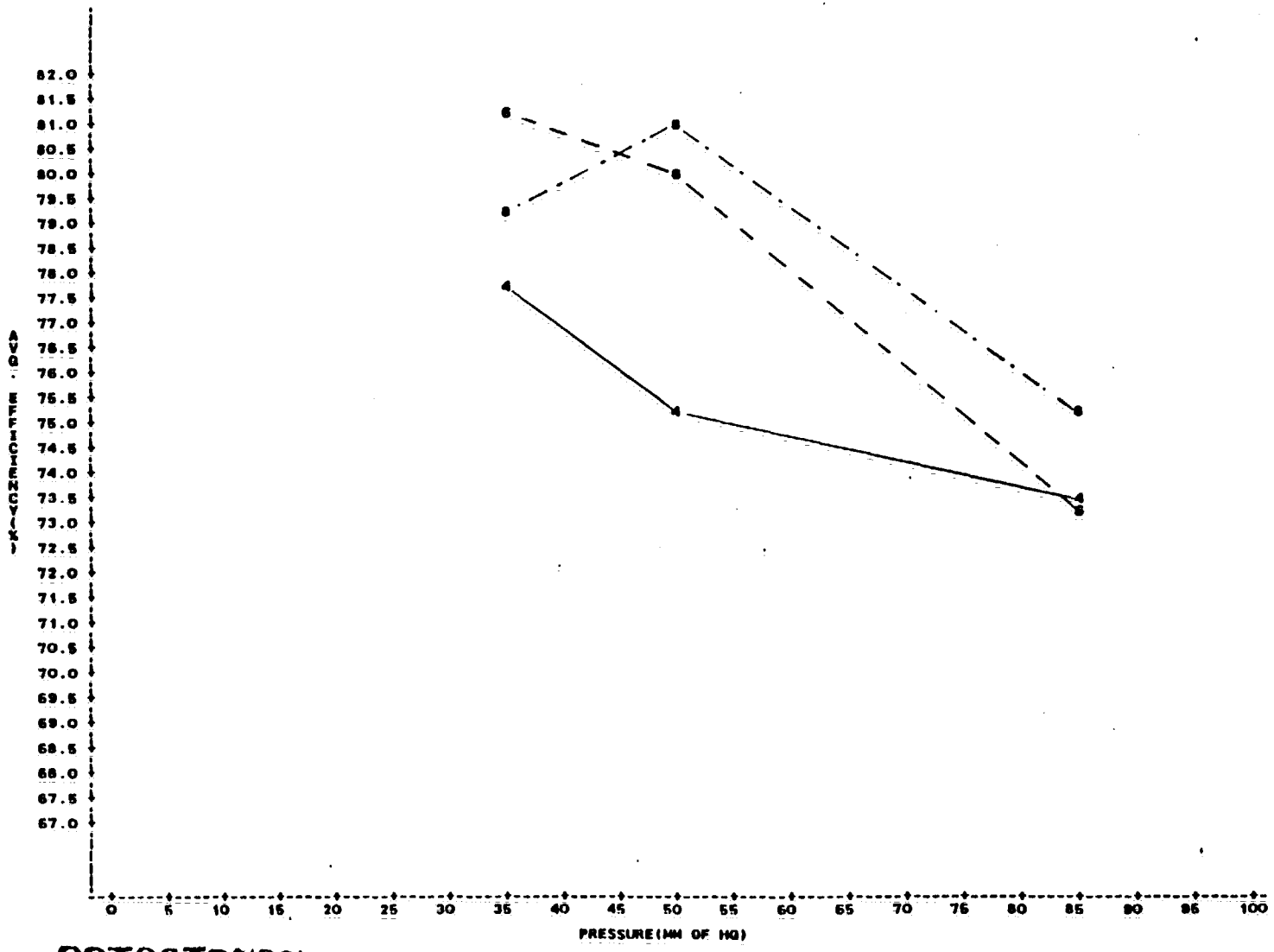


Figure 30

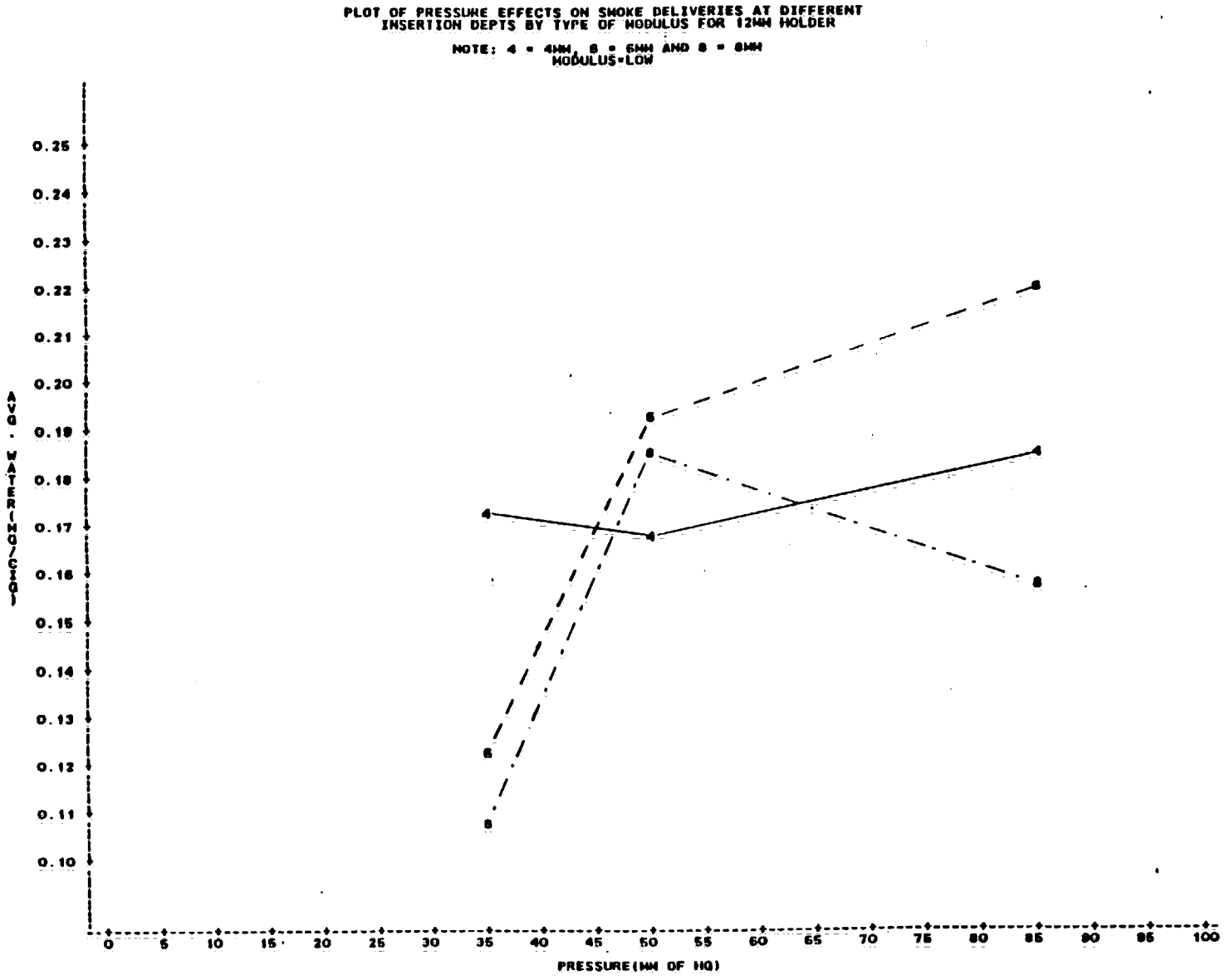


Figure 31

PLOT OF PRESSURE EFFECTS ON SMOKE DELIVERIES AT DIFFERENT INSERTION DEPTS BY TYPE OF MODULUS FOR 12MM HOLDER

NOTE: 4 = 4MM, 6 = 6MM AND 8 = 8MM
MODULUS=MEDIUM

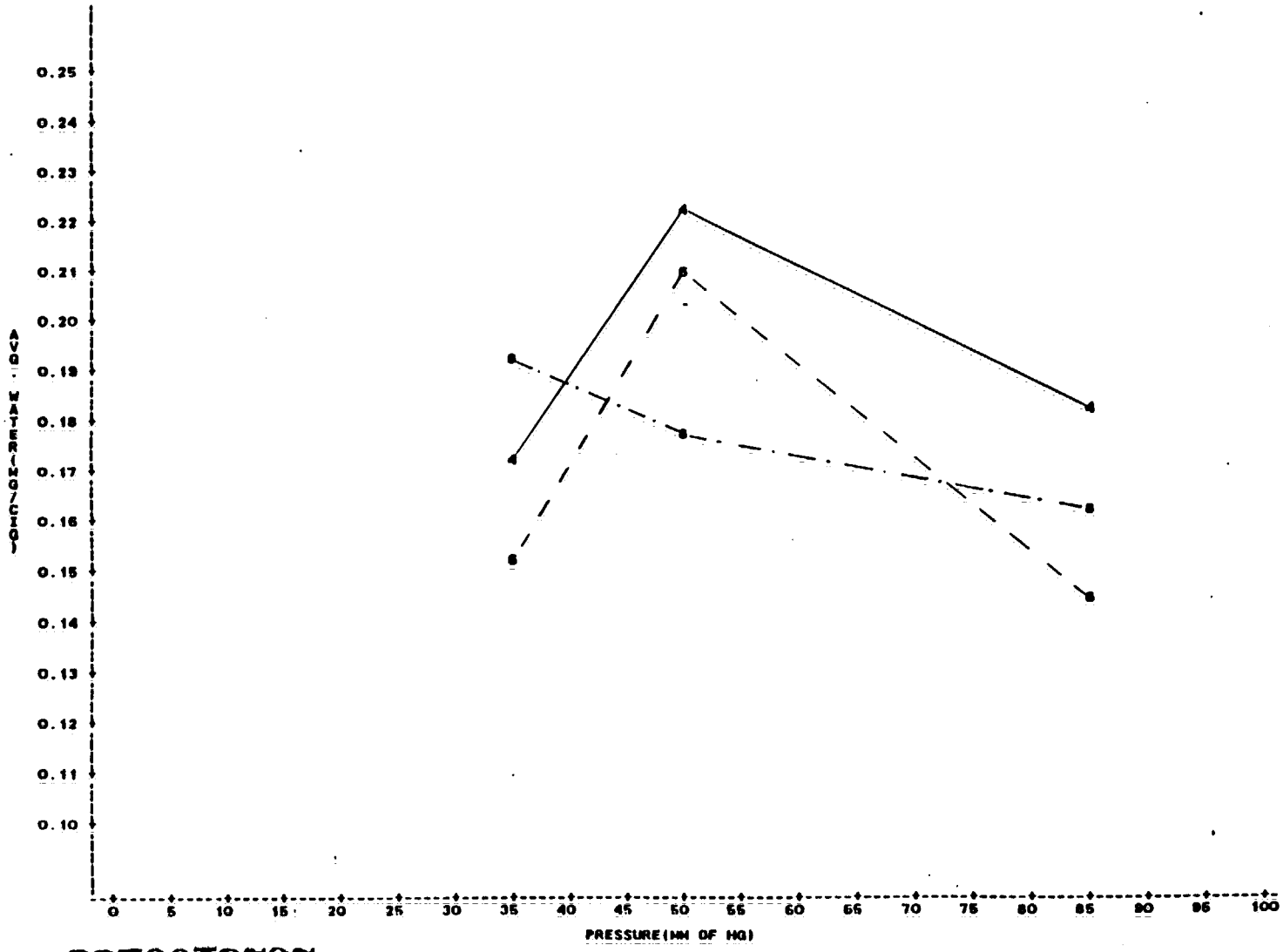


Figure 32

Experimental Determination of Pressure that is Necessary to Obtain Approximately 60% Cigarette Ventilation and Its Effect on Smoke Deliveries

Smoke Deliveries at 175 mm (Hg) of Pressure

Modulus	Insertion Length (mm)		Tar (mg/cig)	Nicotine (mg/cig)	CO (mg/cig)	Filter Nicotine (mg/CO)	Puff (/cig.)	Filter Efficiency (%)	H_2O (mg/cig)		Pressure (mm of Hg)	Cigarette Ventilation (%)		
Medium	6 mm		3.2	0.38	2.7	0.63	8.4	62.4	0.48		150	51.3	57.6	48.2
			4.0	0.48	3.8	0.73	8.0	60.3	0.63		163	61.1	59.5	
			5.0	0.58	4.7	0.82	7.9	58.6	0.74		175	62.0	61.0	61.9
			3.8	0.47	3.5	0.74	7.9	61.2	0.70		213	61.6		
			3.5	0.43	2.9	0.68	7.6	61.3	0.46		225	65.7		
			5.4	0.60	5.1	0.86	7.5	58.9	0.66	$\bar{x}$ =	174	58.9		
			3.9	0.48	3.6	0.73	8.3	60.8	0.64	s =	26.0	5.33		
			3.9	0.46	3.5	0.67	7.9	59.3	0.62	n =	10	10		
		$\bar{x}$ =	4.1	0.49	3.7	0.73	7.9	60.3	0.62					
		s =	0.74	0.07	0.82	0.08	0.31	1.31	0.10					
		n =	8	8	8	8	8	8	8					
Medium	8 mm		3.1	0.36	2.2	0.57	8.3	61.3	0.48		175	65.2	68.3	71.2
			4.8	0.56	4.3	0.82	7.9	59.4	0.57		175	47.5	73.9	65.8
			2.2	0.31	1.9	0.62	8.3	66.7	0.26		175	56.1		
			3.2	0.36	2.3	0.60	8.4	62.5	0.28					
			2.7	0.89	2.5	0.65	8.0	42.2	0.44					
			2.2	0.43	2.1	0.55	8.3	56.1	0.40					
			3.4	0.42	2.8	0.68	8.1	61.8	0.38	$\bar{x}$ =	175	64.0		
			1.9	0.25	1.5	0.55	8.3	68.8	0.28	s =	0	9.20		
		$\bar{x}$ =	2.9	0.45	2.5	0.63	8.2	59.9	0.39	n =	7	7		
		s =	0.93	0.20	0.84	0.09	0.18	8.16	0.11					
		n =	8	8	8	8	8	8	8					

APPENDIX A

CIGARETTE VENTILATION DATA

Figure A1

LISTING OF VENTILATION FOR INDIVIDUAL CIGARETTES BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES FOR LOW MODULUS

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	VENTILATION %	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	0MM	82.8	88	86.5	89.9	79.8	83.6	83.5	87.5	84.4	85.8	86.9	87	85.47	2.76	12.00
	15MM	82.5	87.7	86.4	89.8	78.4	82.8	82.9	87.2	83.9	83.8	86.7	86.8	85.00	2.90	12.00
	25MM	82.1	87.6	86.1	89.5	77.6	82.4	82.3	86.4	83.5	83.3	85.9	86.6	84.43	3.19	12.00
	30MM	81.8	87.6	85.8	89.1	76.1	82.2	82.3	86	83	82.2	84.9	86.2	83.83	3.43	12.00
	35MM	81.2	87.6	85.4	88.5	74.4	81.4	82.2	85	82.5	81	83.6	84.8	83.13	3.69	12.00
	40MM	80.9	87.9	85	88.1	72.6	80.5	81.9	83.8	81.7	79.5	81.5	83.9	82.27	4.11	12.00
	45MM	80.2	88.1	84.1	87.7	71	79.4	81.8	83.1	81	78.5	78.3	83.8	81.26	4.75	12.00
	50MM	80	88.1	83.6	87.4	69.4	78.1	81.7	82.2	80.4	74	76.7	83.1	80.38	5.32	12.00
	55MM	79.6	87.8	83.1	87	67	77.1	81.6	81.6	79.8	70.6	75.8	82.5	79.47	6.12	12.00
	60MM	79	87.7	82.7	86.2	65	75.8	81.3	80.7	79	67.5	74.6	81.9	78.45	6.82	12.00
	65MM	78.4	87.7	82.1	85.4	63.1	74.9	80.9	80.4	78.5	64.2	73.3	81	77.49	7.57	12.00
	70MM	78	87.5	81.4	84.7	60.4	73.8	80.8	79.7	77.8	60.3	72	80.3	76.40	8.57	12.00
	75MM	77.5	87.5	80.6	84.2	58.6	72.8	80.6	79.2	77	57.6	71.1	79.7	75.53	9.22	12.00
	85MM	76.4	87.2	79.1	82.9	54.3	69.3	79.9	78.4	75.9	53.9	68.5	77.5	73.61	10.44	12.00
	100MM	75.1	86.6	76.3	80.2	49.5	66	78.8	76	74.3	48.1	66.2	74.6	70.97	11.74	12.00
6MM	0MM	87.9	82.1	86.6	89.6	89.5	88.5	89.9	84.4	80.1	81.7	83.8	80	85.34	3.78	12.00
	15MM	87.7	81.9	86.5	89.4	89.3	88.3	89.8	84.5	80.1	81.4	83.6	80	85.22	3.76	12.00
	25MM	87.7	82.1	86.3	89.3	89.2	88	89.8	84.5	79.6	81.1	83.1	79.8	85.05	3.84	12.00
	30MM	87.5	82	86	89.4	89.1	87.9	89.7	84.5	79.2	80.7	83.1	79.8	84.92	3.87	12.00
	35MM	87.4	81.9	85.6	89.2	88.8	87.5	89.8	84.5	79	80.3	81.9	79.8	84.65	3.95	12.00
	40MM	87.3	81.5	84.9	89.1	88.6	86.6	89.7	84.4	78.7	79.5	81.7	79.8	84.30	4.01	12.00
	45MM	87.2	81.2	84	88.8	87.9	86.1	89.6	84.2	78.4	78.8	81.5	79.7	83.96	3.99	12.00
	50MM	87.1	80.6	83.3	88.1	87.5	84.9	89.5	84	78.4	78.1	81	79.7	83.62	3.96	12.00
	55MM	86.9	80.4	82.1	87.4	87	83.7	89.2	83.6	77.8	77.7	80.9	79.5	83.02	3.92	12.00
	60MM	86.5	79.1	79.8	87	86.3	82.1	88.7	83	77.3	77.1	80.8	79.4	82.26	4.00	12.00
	65MM	85.7	77.9	77.4	86.6	85.6	81.2	87.9	82.4	76.7	76.4	80.6	79.3	81.47	4.11	12.00
	70MM	84.7	77.2	76.2	86.4	84.9	79.8	87.4		76.1	75.5	80.4	79.2	80.71	4.41	11.00
	75MM	84.2	76.5	75.2	85.7	84.6	78.6	86.9	81.8	75.3	75.1	80.2	79.2	80.27	4.32	12.00
	85MM	83.1	75	72.2	84.6	83.3	75.4	86	81	74.2	73.9	79.6	77.7	78.83	4.73	12.00
	100MM	82.2	72.8	67.4	82.7	81.6	70.6	73	79.8	73	71	78.3	77.1	75.77	5.14	12.00

(CONTINUED)

Figure A1 (cont.)

LISTING OF VENTILATION FOR INDIVIDUAL CIGARETTES BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES FOR LOW MODULUS

HOLDER 12MM

INSERTION LENGTH	PRESSURE(MM OF HG)	CIGARETTE 1 VENTILATION %	2	3	4	5	6	7	8	9	10	11	12	AVG.	STD.	N
8MM	0MM	83.4	86.4	88.2	83.3	86.1	86.3	89.1	85.8	82.6	89	85.6	88.2	86.17	2.22	12.00
	15MM	83.1	86.3	88.2	83.3	88	86.1	89.1	85.6	83.1	89.1	85.5	88	86.12	2.19	12.00
	25MM	82.4	86.2	88.2	83.2	85.9	86.2	89.1	85.6	83	89	84.8	88.1	86.06	2.43	12.00
	30MM	81.7	86.2	88.4	83.2	86	85.9	89	85.3	82.8	88.9	84.6	88	85.82	2.45	12.00
	35MM	81.7	86.1	88.2	83.1	86	85.8	88.9	85.1	82.9	88.7	85.3	88	85.82	2.37	12.00
	40MM	81.6	85.9	88.3	83.3	86.1	85.8	88.9	84.8	82.9	88.8	85.2	87.8	85.78	2.39	12.00
	45MM	81.4	86	88.2	83.2	85.9	85.8	88.6	84.2	82.8	88.8	85.3	87.6	85.63	2.43	12.00
	50MM	80.9	85.9	88.1	83	85.7	85.6	88.2	83.9	82.6	88.7	85.3	87.2	85.42	2.44	12.00
	55MM	81.3	85.9	88.1	82.8	85.7	85.1	87.8	83.2	82.3	88.6	85.2	86.2	85.17	2.36	12.00
	60MM	80.9	85.9	88	82.6	85.6	84.8	87.7	83.1	82	88.3	85	85.8	84.97	2.42	12.00
	65MM	80.4	85.9	88	82.5	85.4	84.4	87.4	82.8	81.7	87.9	84.9	85.7	84.75	2.48	12.00
	70MM	80.1	85.8	87.9	82.4	84.4	84.2	87.3	82.3	81.1	87.7	84.6	85.4	84.43	2.56	12.00
	75MM	79.6	85.6	88	82.2	84.4	83.9	87.1	81.9	80.4	86.6	84.3	85.1	84.09	2.63	12.00
	85MM	78.9	85.4	87.7	81.8	83.8	83	86.8	81.2	78.4	85.8	83.4	84.6	83.38	2.92	12.00
	100MM	77.6	85	87.5	80.9	.	82	86.5	80	75.2	84.2	82.2	83.8	82.17	3.61	11.00
10MM	0MM	87.1	86.6	87.2	87.4	87.8	82.4	82.1	83	87.4	79.2	85.6	82.9	84.90	2.85	12.00
	15MM	86.9	86.6	87.1	87.3	87.8	82.4	82	83.4	87.4	79.1	85.7	82.9	84.89	2.83	12.00
	25MM	86.9	86.6	87.2	87.3	87.8	82.5	82.1	83.1	87.3	79.3	85.7	82.6	84.87	2.80	12.00
	30MM	86.9	86.7	87.3	87.3	87.8	82.5	82.1	83.2	87.3	79.1	85.7	82.7	84.88	2.84	12.00
	35MM	86.8	86.7	87.3	87.1	87.7	82.4	81.9	83	87.3	78.9	85.6	82.5	84.77	2.90	12.00
	40MM	86.9	86.6	87.3	87	87.8	82.4	81.7	83.1	87.3	78.7	85.7	82.5	84.76	2.96	12.00
	45MM	86.9	86.5	87.2	86.9	87.8	82.6	81.8	83.1	87.3	78.5	85.7	82.4	84.73	2.96	12.00
	50MM	86.8	86.7	87.2	86.7	87.8	82.5	81.7	83.2	87.4	78.4	85.7	82.2	84.69	2.98	12.00
	55MM	86.8	86.6	87.3	86.8	87.6	82.4	81.6	83.2	87.4	78.1	85.8	82.1	84.64	3.07	12.00
	60MM	86.7	86.6	87.4	86.3	87.4	82.3	81.3	83.1	87.2	77.8	85.3	81.9	84.44	3.10	12.00
	65MM	86.7	86.6	87.3	86.2	87	82.2	81.3	83.1	87.3	77.5	85.3	81.8	84.36	3.14	12.00
	70MM	86.7	86.4	87.3	86.1	86.4	82.2	81.1	83.1	87.2	76.9	85.5	81.6	84.21	3.23	12.00
	75MM	86.6	86.5	87.4	85.7	85.7	82.2	80.8	83.1	87.2	76.1	85.4	81.5	84.02	3.38	12.00
	85MM	85.5	86.3	87.3	84.1	85.3	81.7	80.1	83.1	87.2	72.1	85.3	80.8	83.23	4.24	12.00
	100MM	84.7	85.3	87.3	82.6	84.3	80.9	78.8	82.9	87.3	69.8	85.2	80.1	82.40	4.86	12.00

Figure A1 (cont.)

LISTING OF VENTILATION FOR INDIVIDUAL CIGARETTES BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES FOR MEDIUM MODULUS

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION	VENTILATION			
		%	%	%	%	%	%	%	%	%	%	%	%	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	0MM	85.4	87.6	85.8	89.5	89.5	83.1	.	87.6	85.6	88.1	84.5	88	86.79	2.06	11.00
	15MM	85.2	87.3	85.7	89.4	89.1	82.6	81.3	87.2	85.3	88.1	84.1	87.9	86.09	2.55	12.00
	25MM	85.3	86.8	85.6	89.2	88.8	82.2	81.4	87	84.6	88.1	84.1	87.4	85.87	2.48	12.00
	30MM	85.2	86	85.6	89	88.3	81.8	80.7	86.7	84.1	87.8	84.1	86.7	85.50	2.61	12.00
	35MM	85.4	84.2	85.6	89.1	88.1	81.8	80.6	86.6	83.5	87.5	84	85	85.12	2.61	12.00
	40MM	85.6	83	85.3	89	87.9	81.8	80.3	86.2	82.8	87.3	83.9	83.7	84.74	2.60	12.00
	45MM	85.4	81.5	85	88.8	87.8	81.6	80	86	81.7	87	83.6	82.8	84.27	2.83	12.00
	50MM	85.5	80.2	84.7	88.9	87.6	81.5	79.6	85.7	80.4	86.6	83	81.7	83.78	3.13	12.00
	55MM	85.2	79.3	84.3	88.5	87.5	81.4	78.8	85.3	79.7	86.2	82.6	79.9	83.22	3.38	12.00
	60MM	84.6	78.1	83.7	88	87.2	81	77.1	84.5	78.1	85.3	82	78.6	82.43	3.67	12.00
	65MM	84.2	76.9	83.1	87.8	86.9	80.7	75	84.1	78.5	84.8	82	77.6	81.80	4.09	12.00
	70MM	82.4	75.3	82.2	87.5	86.7	79.8	70.9	84	78.2	84.4	81	76.6	80.75	4.87	12.00
	75MM	82	73.9	81.8	87.3	86.5	78.4	68.4	83.5	77.8	83.7	78.7	76.6	80.06	5.25	12.00
	85MM	80.6	70.1	80.5	86.4	85.7	76.5	66.2	82	76.3	82.8	76.4	73	78.21	6.13	12.00
	100MM	79.2	64.8	78.9	84.3	84.4	77.3	60	80.4	73.5	80.3	73.4	68.4	75.41	7.66	12.00
6MM	0MM	87	85.2	88.4	87.6	88.2	85.6	87.8	91.7	86.5	85.1	86	86.3	87.10	1.84	12.00
	15MM	87	85.2	88.2	87.3	88.2	85.6	86.2	91.7	86.3	84.8	85.9	86	86.86	1.87	12.00
	25MM	86.8	84.7	88.3	87.2	88.2	85.2	86	91.5	86.2	84.3	85.8	86.1	86.69	1.95	12.00
	30MM	86.7	84.8	88.3	87.2	88.1	84.7	86	91.6	86.2	83.6	85.8	85.7	86.56	2.10	12.00
	35MM	86.6	84.3	88.3	87	88	84.3	85.7	91.3	86.2	83	85.7	86	86.37	2.18	12.00
	40MM	86.3	84	88.3	87	87.9	83.8	85.6	91.3	85.8	82.5	85.6	86	86.17	2.32	12.00
	45MM	86.4	83.7	88.3	87	87.8	83.3	85.3	91.2	85.2	81.9	85.5	85.8	85.96	2.48	12.00
	50MM	86.2	83.4	88.2	87.1	87.7	82.6	85.2	91.1	85.1	81.6	85.1	85.9	85.77	2.60	12.00
	55MM	86	83	88.2	86.9	87.7	82.3	83.6	91	84.7	81	85.2	85.8	85.46	2.78	12.00
	60MM	85.6	83	88.1	86.8	87.6	81.6	83	91	84.4	80.2	84.8	85.2	85.08	3.00	12.00
	65MM	85	82.7	88	86.6	87.3	81.1	82.7	90.6	84.1	79.3	84.2	84.6	84.67	3.12	12.00
	70MM	84.6	82.6	87.7	86.5	87.2	80.6	82.3	90.4	83.1	78	84	84.3	84.25	3.37	12.00
	75MM	83.7	82	87.6	86.4	87.1	79.8	82.2	90.2	82.1	77.1	83.7	83.9	83.82	3.69	12.00
	85MM	82.6	81.4	87.5	85.8	86.6	78.4	81.4	89.7	80.8	74.8	82.5	83.6	82.99	4.01	12.00
	100MM	81.1	79.1	86.4	84.1	86.2	78	80	88.9	78.7	71.5	79.2	82.9	81.34	4.70	12.00

(CONTINUED)

Figure A1 (cont.)

LISTING OF VENTILATION FOR INDIVIDUAL CIGARETTES BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES FOR MEDIUM MODULUS

HOLDER 12MM

INSERTION LENGTH	PRESSURE(MM OF HG)	CIGARETTE 1 VENTILATION %	2	3	4	5	6	7	8	9	10	11	12	AVG.	STD.	N
8MM	0MM	87.5	84.4	89.7	86.2	85.1	88.3	88	91.3	89.6	91.7	84.4	87.2	87.70	2.66	12.00
	15MM	87.3	84.4	89.5	84.8	85.1	88.2	88	91.2	89.6	91.5	84.2	87	87.57	2.57	12.00
	25MM	87.4	84.3	89.4	84.8	85.2	88.2	87.4	91.2	89.4	91.6	84.2	86.8	87.49	2.57	12.00
	30MM	87.2	84.1	89.3	84.7	85	88.2	87.7	91.3	89.3	91.6	84.2	86.8	87.43	2.62	12.00
	35MM	87.1	84.1	89.1	84.6	85.1	88.3	87.5	91.3	89.3	91.6	84.1	86.5	87.38	2.63	12.00
	40MM	87.2	84.3	88.7	84.6	84.9	88.3	87.6	91.2	89.2	91.6	84.2	86.9	87.40	2.53	12.00
	45MM	87.2	84.4	88.5	84.6	84.8	88.1	87.6	91.1	88.9	91.2	84.2	86.7	87.27	2.46	12.00
	50MM	87	84.4	88.2	84.4	84.7	88.1	87.5	91	88.1	91.3	84.2	86.6	87.12	2.44	12.00
	55MM	86.9	84.4	88.4	84.6	84.7	88	87.4	91	88	91.1	84.1	86.4	87.10	2.38	12.00
	60MM	86.9	84.3	88	85	84.3	87.9	87.3	91	87.8	91	84	86.2	86.97	2.39	12.00
	65MM	86.9	84.1	87.8	85	84.5	87.7	87.3	90.9	87.4	90.4	83.8	86	86.82	2.29	12.00
	70MM	86.8	84.3	87.8	85	84.2	87.4	87.3	90.8	87	89.8	83.6	85.8	86.65	2.21	12.00
	75MM	86.7	84.2	87.7	84.8	84.2	87.3	87	90.7	86.5	89.4	83.4	85.5	86.45	2.18	12.00
	85MM	86.4	83.3	87.6	84.7	83.9	86.4	86.7	90.7	86.1	89.3	82.4	85.1	86.06	2.40	12.00
	100MM	86.1	82.3	87.4	84.3	83.4	84.7	85.1	90.4	81.4	88.5	81.2	84.4	84.93	2.80	12.00
10MM	0MM	85.4	88.8	82.7	88	91	85.3	86.2	84.2	83.6	86.3	84.1	87.4	86.09	2.41	12.00
	15MM	85.3	88.8	82.7	87.9	90.9	85	86.1	83.7	83.5	86	83.9	87.4	85.94	2.45	12.00
	25MM	85.6	88.7	82.7	87.6	90.7	84.9	85.9	83.6	83.3	85.7	83.8	87.2	85.81	2.40	12.00
	30MM	85.5	88.6	82.6	87.7	90.6	84.8	85.7	83.4	83.2	85.7	83.7	87	85.72	2.44	12.00
	35MM	85.5	88.7	82.6	87.8	90.8	84.8	85.5	83.3	83	85.5	83.7	86.8	85.68	2.50	12.00
	40MM	85.6	88.7	82.6	87.8	90.7	84.7	85.4	83.1	83.1	85.4	83.8	87.2	85.67	2.51	12.00
	45MM	85.3	88.7	82.5	88.1	90.7	84.7	85.2	83.1	83	85.3	83.7	87.1	85.62	2.55	12.00
	50MM	85.2	88.7	82.4	88.1	90.5	84.5	84.8	83.1	82.8	85.3	83.6	87.1	85.52	2.56	12.00
	55MM	85.2	88.6	82.3	88	90.5	84.5	84.3	82.8	82.7	85.2	83.5	87	85.38	2.61	12.00
	60MM	85.2	88.6	82.3	88	90.4	84.4	84.2	82.8	82.6	84.9	83.6	86.9	85.32	2.61	12.00
	65MM	85.1	88.3	81.9	87.8	90.3	84.3	83.7	82.6	82.6	84.6	83.3	86.7	85.09	2.66	12.00
	70MM	85.2	88	81.8	87.7	90.3	84.2	82.9	82.6	82.6	84.4	83.4	86.8	84.98	2.68	12.00
	75MM	85.2	87.8	81.1	87.1	90.2	84.1	82.6	82.2	82.3	84	83.2	86.8	84.72	2.76	12.00
	85MM	85.1	87.7	79.4	86.1	89.3	83.8	82.1	81.7	81.6	83	82.9	86.8	84.12	2.81	12.00
	100MM	85	87.2	77.8	85.3	88.3	83.4	81.5	81	75.7	81.4	82	86.6	82.93	3.78	12.00

Figure A2 (cont.)

LISTING OF CHANGE IN VENTILATION FOR INDIVIDUAL CIGARETTES
BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES
FOR LOW MODULUS
NOTE: CHANGE = INITIAL - OTHERS FOR EACH CIGARETTE

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	CHG IN VEN-T. %	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.30	0.30	0.10	0.10	0.40	0.80	0.60	0.30	0.50	1.90	0.20	0.20	0.48	0.49	12.00
	25MM	0.70	0.40	0.40	0.40	2.20	1.20	1.20	1.10	0.90	2.50	1.00	0.50	1.04	0.69	12.00
	30MM	1.00	0.40	0.70	0.80	3.70	1.40	1.20	1.50	1.40	3.60	2.00	0.80	1.54	1.07	12.00
	35MM	1.60	0.40	1.10	1.40	5.40	2.20	1.30	2.50	1.90	4.80	3.40	2.10	2.34	1.50	12.00
	40MM	1.90	0.10	1.50	1.80	7.20	3.10	1.60	3.70	2.70	6.30	5.40	3.10	3.20	2.13	12.00
	45MM	2.60	-.10	2.40	2.20	8.80	4.20	1.70	4.40	3.40	9.30	8.60	3.10	4.22	3.06	12.00
	50MM	2.80	-.10	2.80	2.50	10.4	5.60	1.80	5.30	4.00	11.8	10.2	3.90	5.08	3.77	12.00
	55MM	3.30	0.10	3.40	2.90	12.8	6.50	1.90	5.80	4.60	15.2	11	4.60	6.01	4.63	12.00
	60MM	3.80	0.30	3.80	3.70	14.8	7.80	2.20	6.80	5.40	18.3	12.3	5.10	7.02	5.42	12.00
	65MM	4.40	0.30	4.40	4.50	16.7	8.70	2.60	7.10	5.90	21.6	13.6	6.00	7.88	6.24	12.00
	70MM	4.80	0.60	5.10	5.20	19.4	9.60	2.70	7.80	6.60	25.5	14.9	6.70	9.07	7.31	12.00
	75MM	5.30	0.50	5.90	5.70	21.2	11	2.90	8.30	7.40	28	15.8	7.30	9.94	7.97	12.00
	85MM	6.40	0.80	7.40	7.00	25.5	14.3	3.60	9.10	8.60	31.9	18.4	8.60	11.07	9.17	12.00
	100MM	7.70	1.40	10.2	9.70	30.3	17.6	4.70	11.5	10.1	37.7	20.7	12.4	14.60	10.65	12.00
6MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.20	0.20	0.10	0.20	0.20	0.20	0.00	-.10	0.00	0.30	0.20	0.00	0.13	0.12	12.00
	25MM	0.20	0.00	0.30	0.30	0.30	0.50	0.00	-.10	0.60	0.60	0.70	0.10	0.28	0.26	12.00
	30MM	0.40	0.10	0.60	0.20	0.40	0.60	0.20	-.10	0.90	1.00	0.70	0.10	0.42	0.34	12.00
	35MM	0.60	0.20	1.00	0.40	0.60	1.00	0.10	-.10	1.10	1.40	1.90	0.20	0.68	0.60	12.00
	40MM	0.60	0.60	1.70	0.50	0.90	1.90	0.20	0.00	1.40	2.40	2.10	0.20	1.04	0.82	12.00
	45MM	0.70	0.90	2.60	0.80	1.60	2.40	0.30	0.20	1.70	2.90	2.30	0.30	1.38	0.98	12.00
	50MM	0.80	1.50	3.30	1.50	2.00	3.60	0.40	0.40	1.70	3.60	2.80	0.30	1.82	1.26	12.00
	55MM	1.00	1.70	4.50	2.20	2.50	4.60	0.70	0.80	2.30	4.00	2.90	0.50	2.32	1.49	12.00
	60MM	1.40	3.00	6.80	2.60	3.20	6.40	1.20	1.40	2.80	4.60	3.00	0.60	3.06	1.97	12.00
	65MM	2.20	4.20	9.20	3.00	4.00	7.30	2.00	2.00	3.40	5.30	3.20	0.70	3.88	2.40	12.00
	70MM	3.20	4.90	10.4	3.20	4.60	8.70	2.60	.	4.00	6.20	3.40	0.80	4.72	2.78	11.00
	75MM	3.70	5.60	11.4	3.90	4.90	9.90	3.00	2.60	4.80	6.60	3.60	0.80	5.07	3.02	12.00
	85MM	4.80	7.10	14.4	5.00	6.20	13.1	3.90	3.40	5.90	7.80	4.20	2.30	6.61	3.73	12.00
	100MM	5.70	9.30	19.2	6.80	7.90	18	16.9	4.60	7.10	10.7	5.50	2.90	9.57	6.61	12.00

(CONTINUED)

Figure A2 (cont.)

LISTING OF CHANGE IN VENTILATION FOR INDIVIDUAL CIGARETTES
BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES
FOR LOW MODULUS
NOTE: CHANGE = INITIAL - OTHERS FOR EACH CIGARETTE

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
8MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.30	0.10	0.00	0.00	0.10	0.20	0.00	0.20	-.50	-.10	0.10	0.20	0.05	0.21	12.00
	25MM	1.00	0.20	-.10	0.10	0.20	0.10	0.00	0.20	-.40	0.00	0.80	0.10	0.11	0.51	12.00
	30MM	1.70	0.20	-.20	0.10	0.10	0.40	0.10	0.50	-.20	0.10	1.10	0.20	0.34	0.55	12.00
	35MM	1.70	0.30	0.00	0.20	0.10	0.40	0.20	0.70	-.30	0.30	0.30	0.20	0.34	0.49	12.00
	40MM	1.80	0.50	-.10	0.00	0.00	0.60	0.20	1.00	-.30	0.20	0.40	0.40	0.38	0.56	12.00
	45MM	2.00	0.40	0.00	0.10	0.20	0.60	0.60	1.60	0.00	0.20	0.30	0.60	0.53	0.63	12.00
	50MM	2.50	0.60	0.10	0.30	0.40	0.70	0.90	1.90	0.00	0.30	0.30	1.00	0.74	0.76	12.00
	55MM	2.10	0.60	0.10	0.50	0.40	1.20	1.30	2.60	0.30	0.60	0.40	2.00	0.99	0.83	12.00
	60MM	2.60	0.60	0.20	0.70	0.60	1.50	1.40	2.70	0.60	0.70	0.60	2.40	1.18	0.89	12.00
	65MM	3.00	0.60	0.20	0.80	0.70	1.90	1.70	3.00	0.90	1.10	0.70	2.60	1.42	0.98	12.00
	70MM	3.30	0.60	0.30	0.90	1.70	2.10	1.80	3.50	1.60	1.30	1.00	2.80	1.73	1.03	12.00
	75MM	3.80	0.80	0.20	1.10	1.70	2.40	2.00	3.90	2.20	2.40	1.30	3.10	2.07	1.15	12.00
	85MM	4.60	1.00	0.60	1.60	2.60	3.30	2.30	4.60	4.20	3.20	2.20	3.60	2.78	1.35	12.00
	100MM	5.80	1.40	0.70	2.40		4.30	3.60	5.80	7.40	4.80	3.40	4.40	4.00	1.98	11.00
10MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.20	0.00	0.10	0.10	0.00	0.00	0.10	-.40	0.00	0.10	-.10	0.00	0.01	0.15	12.00
	25MM	0.20	0.00	0.00	0.10	0.10	-.10	0.00	-.10	0.10	-.10	-.10	0.30	0.03	0.13	12.00
	30MM	0.20	-.10	-.10	0.10	0.10	-.10	0.00	-.20	0.10	0.10	-.10	0.20	0.02	0.13	12.00
	35MM	0.20	-.10	-.10	0.30	0.20	0.00	0.20	0.00	0.10	0.30	0.00	0.40	0.13	0.17	12.00
	40MM	0.20	0.00	-.10	0.40	0.00	0.00	0.40	-.10	0.10	0.60	-.10	0.40	0.14	0.23	12.00
	45MM	0.20	0.10	0.00	0.50	0.00	-.20	0.30	-.10	0.10	0.70	-.10	0.60	0.17	0.28	12.00
	50MM	0.30	-.10	0.00	0.70	0.10	-.10	0.40	-.20	0.00	0.80	-.10	0.70	0.21	0.36	12.00
	55MM	0.30	0.00	-.10	0.60	0.30	0.00	0.50	-.20	0.00	1.10	-.20	0.80	0.26	0.42	12.00
	60MM	0.40	0.00	-.20	1.10	0.50	0.10	0.80	-.10	0.20	1.40	0.30	1.00	0.46	0.61	12.00
	65MM	0.40	0.00	-.10	1.20	0.90	0.20	0.80	-.10	0.10	1.70	0.30	1.10	0.54	0.59	12.00
	70MM	0.40	0.20	-.10	1.30	1.50	0.20	1.00	-.10	0.20	2.30	0.10	1.30	0.69	0.77	12.00
	75MM	0.50	0.10	-.20	1.70	2.20	0.20	1.30	-.10	0.20	3.10	0.20	1.40	0.88	1.05	12.00
	85MM	1.60	0.30	-.10	3.30	2.60	0.70	2.00	-.10	0.20	7.10	0.30	2.10	1.67	2.05	12.00
	100MM	2.40	1.30	-.10	4.80	3.60	1.60	3.50	0.10	0.10	9.60	0.40	2.80	2.50	2.76	12.00

Figure A2 (cont.)

LISTING OF CHANGE IN VENTILATION FOR INDIVIDUAL CIGARETTES
BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES
FOR MEDIUM MODULUS
NOTE: CHANGE = INITIAL - OTHERS FOR EACH CIGARETTE

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.	CHG IN VEN-T.			
		%	%	%	%	%	%	%	%	%	%	%	%	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.20	0.30	0.10	0.10	0.40	0.60	.	0.40	0.30	0.00	0.40	0.10	0.26	0.18	11.00
	25MM	0.10	0.80	0.20	0.30	0.70	0.90	.	0.60	1.00	0.00	0.40	0.60	0.51	0.33	11.00
	30MM	0.20	1.60	0.20	0.60	1.20	1.30	.	0.90	1.50	0.30	0.40	1.30	0.85	0.66	11.00
	35MM	0.00	3.40	0.20	0.40	1.40	1.30	.	1.00	2.10	0.60	0.60	3.00	1.26	1.13	11.00
	40MM	-.20	4.60	0.60	0.60	1.60	1.30	.	1.40	2.70	0.80	0.60	4.30	1.65	1.58	11.00
	45MM	0.00	6.10	0.80	0.60	1.70	1.60	.	1.60	3.90	1.10	0.90	5.20	2.13	2.01	11.00
	50MM	-.10	7.40	1.10	0.60	1.90	1.60	.	1.90	5.20	1.60	1.60	6.30	2.63	2.48	11.00
	55MM	0.20	8.30	1.60	1.00	2.00	1.70	.	2.30	5.90	1.90	1.90	8.10	3.16	2.86	11.00
	60MM	0.80	9.60	2.10	1.60	2.30	2.10	.	3.10	6.60	2.80	2.60	9.40	3.87	3.11	11.00
	65MM	1.20	10.7	2.70	1.70	2.60	2.40	.	3.60	7.10	3.30	2.60	10.4	4.37	3.41	11.00
	70MM	3.00	12.3	3.60	2.00	2.80	3.30	.	3.60	7.40	3.70	3.60	11.4	5.16	3.58	11.00
	75MM	3.40	13.7	4.00	2.20	3.00	3.70	.	4.10	7.80	4.40	4.80	12.4	5.77	3.87	11.00
	85MM	4.80	17.5	5.30	3.10	3.80	4.60	.	5.60	9.30	5.30	6.10	15	7.48	4.71	11.00
	100MM	6.20	22.8	6.90	5.20	5.10	5.80	.	7.20	12.1	7.80	11.1	19.6	9.98	6.03	11.00
6MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.00	0.00	0.20	0.20	0.00	0.00	1.60	0.00	0.20	0.30	0.10	0.30	0.24	0.44	12.00
	25MM	0.20	0.50	0.10	0.30	0.00	0.30	1.80	0.20	0.30	0.80	0.20	0.20	0.41	0.48	12.00
	30MM	0.30	0.40	0.10	0.30	0.10	0.80	1.80	0.10	0.30	1.50	0.20	0.60	0.54	0.56	12.00
	35MM	0.40	0.90	0.10	0.50	0.20	1.20	2.10	0.40	0.30	2.10	0.30	0.30	0.73	0.71	12.00
	40MM	0.70	1.20	0.10	0.60	0.30	1.70	2.20	0.40	0.70	2.60	0.40	0.30	0.93	0.82	12.00
	45MM	0.60	1.60	0.10	0.60	0.40	2.20	2.60	0.50	1.30	3.20	0.60	0.60	1.15	1.00	12.00
	50MM	0.80	1.80	0.20	0.40	0.60	2.90	2.60	0.60	1.40	3.60	0.90	0.40	1.33	1.12	12.00
	55MM	1.00	2.20	0.20	0.60	0.60	3.20	4.20	0.70	1.80	4.10	0.80	0.60	1.65	1.45	12.00
	60MM	1.60	2.20	0.30	0.70	0.70	4.00	4.80	0.70	2.10	4.90	1.20	1.10	2.02	1.65	12.00
	65MM	2.00	2.50	0.40	0.90	0.80	4.40	5.10	1.10	2.40	5.80	1.80	1.80	2.42	1.76	12.00
	70MM	2.50	2.70	0.70	1.00	1.00	5.00	5.50	1.30	3.40	7.10	2.00	2.00	2.85	2.03	12.00
	75MM	3.30	3.20	0.80	1.10	1.10	5.60	5.60	1.50	4.40	8.00	2.30	2.40	3.27	2.23	12.00
	85MM	4.50	3.80	0.90	1.70	1.60	6.10	6.40	2.00	5.70	10.3	3.50	2.80	4.11	2.68	12.00
	100MM	6.90	6.10	2.00	3.40	2.00	7.50	7.80	2.60	7.80	13.8	5.80	3.40	5.76	3.33	12.00

(CONTINUED)

Figure A2 (cont.)

LISTING OF CHANGE IN VENTILATION FOR INDIVIDUAL CIGARETTES
BY HOLDER LENGTHS, INSERTION LENGTHS AND PRESSURES
FOR MEDIUM MODULUS
NOTE: CHANGE = INITIAL - OTHERS FOR EACH CIGARETTE

HOLDER 12MM

		CIGARETTE														
		1	2	3	4	5	6	7	8	9	10	11	12			
		CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	CHG IN VENT. %	AVG.	STD.	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
8MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.30	0.00	0.20	0.40	0.00	0.10	0.00	0.10	0.00	0.20	0.20	0.20	0.13	0.12	12.00
	25MM	0.10	0.10	0.30	0.40	-.10	0.10	0.60	0.10	0.20	0.10	0.20	0.40	0.21	0.18	12.00
	30MM	0.30	0.30	0.40	0.60	0.10	0.10	0.30	0.00	0.30	0.10	0.20	0.60	0.27	0.18	12.00
	35MM	0.40	0.30	0.60	0.60	0.00	0.00	0.60	0.00	0.30	0.10	0.30	0.70	0.32	0.25	12.00
	40MM	0.30	0.10	1.00	0.40	0.20	0.00	0.40	0.10	0.40	0.20	0.20	0.30	0.30	0.26	12.00
	45MM	0.30	0.00	1.20	0.60	0.30	0.20	0.40	0.20	0.70	0.50	0.20	0.50	0.43	0.31	12.00
	50MM	0.50	0.00	1.50	0.80	0.40	0.20	0.50	0.30	1.50	0.40	0.20	0.60	0.57	0.48	12.00
	55MM	0.60	0.00	1.30	0.40	0.40	0.30	0.60	0.30	1.60	0.60	0.30	0.80	0.60	0.45	12.00
	60MM	0.60	0.10	1.70	0.20	0.80	0.40	0.70	0.30	1.80	0.70	0.40	1.00	0.72	0.54	12.00
	65MM	0.60	0.30	1.90	0.20	0.60	0.60	0.70	0.40	2.20	1.30	0.60	1.20	0.88	0.64	12.00
	70MM	0.70	0.10	1.90	0.20	0.90	0.90	0.70	0.50	2.60	1.90	0.80	1.40	1.06	0.75	12.00
	75MM	0.80	0.20	2.00	0.40	0.90	1.00	1.00	0.60	3.10	2.30	1.00	1.70	1.26	0.86	12.00
	85MM	1.10	1.10	2.10	0.50	1.20	1.90	1.30	0.60	3.50	2.40	2.00	2.10	1.66	0.85	12.00
	100MM	1.40	2.10	2.30	0.90	1.70	3.60	2.90	0.90	5.20	3.20	3.20	2.80	2.77	1.84	12.00
10MM	0MM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.00
	15MM	0.10	0.00	0.00	0.10	0.10	0.30	0.10	0.50	0.10	0.30	0.20	0.00	0.15	0.15	12.00
	25MM	-.20	0.20	0.00	0.40	0.30	0.40	0.30	0.60	0.30	0.60	0.30	0.20	0.28	0.22	12.00
	30MM	-.10	0.10	0.10	0.30	0.40	0.50	0.50	0.80	0.40	0.60	0.40	0.40	0.37	0.24	12.00
	35MM	-.10	0.20	0.10	0.10	0.20	0.60	0.70	0.90	0.60	0.80	0.40	0.60	0.41	0.31	12.00
	40MM	-.10	0.20	0.10	0.10	0.30	0.60	0.80	1.10	0.60	0.90	0.30	0.20	0.42	0.37	12.00
	45MM	0.10	0.20	0.20	-.10	0.30	0.60	1.00	1.10	0.60	1.00	0.40	0.30	0.47	0.39	12.00
	50MM	0.20	0.20	0.30	-.10	0.50	0.80	1.30	1.10	0.80	1.00	0.50	0.30	0.58	0.42	12.00
	55MM	0.20	0.30	0.40	0.00	0.60	0.80	1.90	1.40	0.90	1.10	0.60	0.40	0.71	0.55	12.00
	60MM	0.20	0.30	0.40	0.00	0.60	0.90	2.00	1.30	1.10	1.40	0.60	0.50	0.77	0.58	12.00
	65MM	0.30	0.60	0.80	0.10	0.70	1.00	2.50	1.70	1.10	1.70	0.80	0.70	1.00	0.67	12.00
	70MM	0.20	0.90	0.90	0.30	0.70	1.10	3.30	1.70	1.10	1.90	0.70	0.50	1.11	0.86	12.00
	75MM	0.20	1.00	1.60	0.90	0.80	1.20	3.60	2.00	1.30	2.30	0.90	0.60	1.37	0.91	12.00
	85MM	0.30	1.20	3.30	1.90	1.70	1.50	4.10	2.50	2.00	3.30	1.20	0.60	1.97	1.15	12.00
	100MM	0.40	1.70	4.90	2.70	2.70	1.90	4.70	3.20	7.80	4.90	2.10	0.80	3.16	2.12	12.00

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APPENDIX B

SMOKING DATA

Figure B1

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE-TAR(MG/CIG)

MODULUS LOW

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.70	0.70	0.80	1.00	0.40	0.70	0.72	0.18	6.00
	60MM	0.80	0.60	1.60	0.60	0.90	0.70	0.85	0.38	6.00
	85MM	1.20	1.20	2.20	1.10	1.20	1.80	1.45	0.46	6.00
6MM	35MM	0.70	0.80	0.80	0.80	0.80	0.80	0.78	0.04	6.00
	60MM	0.60	0.90	0.60	0.60	0.90	1.20	0.80	0.24	6.00
	85MM	2.10	1.30	1.20	1.20	1.50	1.50	1.47	0.34	6.00
8MM	35MM	0.40	0.70	0.70	0.70	0.80	0.80	0.63	0.15	6.00
	60MM	0.70	0.60	0.70	0.70	0.60	0.90	0.70	0.11	6.00
	85MM	1.00	0.90	1.00	1.00	0.90	1.10	0.98	0.08	6.00

MODULUS MEDIUM

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.80	0.90	0.60	1.10	0.60	1.00	0.82	0.23	6.00
	60MM	1.20	1.00	1.00	0.30	0.30	0.60	0.72	0.40	6.00
	85MM	1.60	2.30	1.30	1.00	0.80	1.10	1.36	0.54	6.00
6MM	35MM	0.60	0.60	0.60	0.80	0.70	0.60	0.60	0.13	6.00
	60MM	0.90	0.80	0.60	0.60	1.00	0.40	0.70	0.24	6.00
	85MM	0.90	1.20	1.40	1.20	1.20	0.90	1.13	0.20	6.00
8MM	35MM	0.80	0.70	0.60	0.60	0.60	0.40	0.68	0.15	6.00
	60MM	0.60	0.20	0.70	0.60	0.80	0.70	0.68	0.21	6.00
	85MM	0.80	0.80	1.10	0.80	1.30	0.80	0.85	0.21	6.00

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=NICOTINE(MG/CIG)

MODULUS LOW

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.09	0.09	0.08	0.11	0.07	0.10	0.09	0.01	6.00
	60MM	0.10	0.09	0.19	0.08	0.11	0.09	0.11	0.04	6.00
	85MM	0.14	0.16	0.26	0.13	0.16	0.23	0.18	0.05	6.00
6MM	35MM	0.09	0.09	0.09	0.10	0.09	0.09	0.09	0.00	6.00
	60MM	0.10	0.12	0.08	0.08	0.12	0.14	0.11	0.02	6.00
	85MM	0.27	0.16	0.16	0.16	0.19	0.17	0.18	0.05	6.00
8MM	35MM	0.05	0.06	0.07	0.09	0.11	0.06	0.07	0.02	6.00
	60MM	0.10	0.08	0.09	0.11	0.09	0.11	0.10	0.01	6.00
	85MM	0.13	0.12	0.12	0.15	0.11	0.15	0.13	0.02	6.00

MODULUS MEDIUM

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.10	0.10	0.06	0.14	0.07	0.11	0.10	0.03	6.00
	60MM	0.14	0.14	0.15	0.07	0.13	0.07	0.12	0.04	6.00
	85MM	0.18	0.25	0.16	0.13	0.09	0.11	0.15	0.06	6.00
6MM	35MM	0.07	0.06	0.07	0.09	0.04	0.06	0.06	0.02	6.00
	60MM	0.10	0.10	0.09	0.07	0.12	0.07	0.09	0.02	6.00
	85MM	0.12	0.13	0.17	0.15	0.14	0.10	0.13	0.02	6.00
8MM	35MM	0.09	0.08	0.07	0.08	0.07	0.06	0.07	0.01	6.00
	60MM	0.07	0.04	0.09	0.09	0.11	0.09	0.08	0.02	6.00
	85MM	0.10	0.11	0.13	0.10	0.12	0.11	0.11	0.01	6.00

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=CO(MG/CIG)

MODULUS LOW

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	7 RESULT	8 RESULT	9 RESULT	10 RESULT	11 RESULT	12 RESULT	AVG	STD	N
4MM	35MM	0.10	0.40	0.40	0.30	0.30	0.20	0.30	0.50	0.10	0.30	0.40	0.20	0.29	0.12	12.00
	60MM	0.20	0.70	0.40	0.20	1.00	1.00	0.30	0.20	0.30	0.90	0.60	0.20	0.60	0.32	12.00
	85MM	0.80	0.20	0.90	0.80	2.40	1.00	0.20	0.80	0.60	0.40	1.30	1.00	0.87	0.59	12.00
6MM	35MM	0.30	0.20	0.30	0.30	0.30	0.30	0.30	0.40	0.50	0.30	0.30	0.60	0.34	0.11	12.00
	60MM	0.40	0.60	0.60	0.30	0.40	0.20	0.20	0.60	0.60	0.60	0.60	0.60	0.46	0.15	12.00
	85MM	2.00	0.40	0.20	1.10	0.70	0.60	1.00	0.20	1.00	0.90	1.40	0.70	0.85	0.51	12.00
8MM	35MM	0.20	0.60	0.20	0.40	0.20	0.30	0.40	0.30	0.40	0.30	0.10	0.20	0.30	0.13	12.00
	60MM	0.30	0.40	0.30	0.30	0.30	0.30	0.60	0.60	0.60	0.40	0.60	0.60	0.42	0.12	12.00
	85MM	0.60	0.60	0.60	0.60	0.60	0.30	0.30	1.00	0.70	0.60	0.80	0.70	0.60	0.20	12.00

MODULUS MEDIUM

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	7 RESULT	8 RESULT	9 RESULT	10 RESULT	11 RESULT	12 RESULT	AVG	STD	N
4MM	35MM	0.60	0.30	0.30	0.60	0.10	0.30	0.60	0.40	0.30	0.20	0.60	0.60	0.39	0.17	12.00
	60MM	0.60	0.80	0.60	0.30	0.50	0.60	0.00	0.60	0.80	0.40	0.30	0.30	0.48	0.24	12.00
	85MM	1.10	1.00	1.30	1.70	0.90	1.00	0.50	0.40	0.40	0.30	0.60	0.60	0.81	0.43	12.00
6MM	35MM	0.30	0.30	0.30	0.30	0.30	0.30	0.20	0.50	0.40	0.30	0.20	0.10	0.29	0.10	12.00
	60MM	0.60	0.60	0.60	0.60	0.60	0.30	0.40	0.20	0.30	1.30	0.20	0.20	0.46	0.30	12.00
	85MM	0.60	0.60	0.60	1.00	1.00	0.60	0.60	0.60	0.60	0.80	0.40	0.40	0.60	0.20	12.00
8MM	35MM	0.60	0.30	0.60	0.30	0.30	0.30	0.30	0.20	0.40	0.10	0.20	0.10	0.31	0.16	12.00
	60MM		0.20	0.10	0.30	0.60	0.60	0.60	0.30	1.10	0.30	0.30	0.30	0.40	0.26	11.00
	85MM	0.60	0.90	0.30	0.90	0.60	0.60	0.40	0.30	0.80	0.60	0.20	0.40	0.54	0.24	12.00

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE-FILTER NICOTINE(MG/CIG)

MODULUS LOW

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.30	0.28	0.28	0.32	0.22	0.31	0.29	0.04	6.00
	50MM	0.30	0.30	0.46	0.26	0.29	0.28	0.32	0.07	6.00
	65MM	0.35	0.41	0.54	0.44	0.41	0.54	0.46	0.08	6.00
6MM	35MM	0.30	0.32	0.30	0.26	0.33	0.34	0.31	0.03	6.00
	50MM	0.40	0.34	0.33	0.32	0.37	0.38	0.36	0.03	6.00
	65MM	0.42	0.37	0.38	0.34	0.46	0.48	0.41	0.06	6.00
8MM	35MM	0.26	0.26	0.28	0.32	0.28	0.26	0.28	0.02	6.00
	50MM	0.35	0.31	0.33	0.36	0.30	0.30	0.32	0.03	6.00
	65MM	0.40	0.34	0.35	0.40	0.39	0.36	0.37	0.03	6.00

MODULUS MEDIUM

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.30	0.33	0.30	0.40	0.29	0.37	0.33	0.04	6.00
	50MM	0.44	0.39	0.36	0.27	0.32	0.31	0.35	0.06	6.00
	65MM	0.43	0.52	0.46	0.36	0.30	0.40	0.41	0.08	6.00
6MM	35MM	0.27	0.25	0.29	0.28	0.32	0.24	0.27	0.03	6.00
	50MM	0.42	0.40	0.37	0.38	0.36	0.28	0.37	0.05	6.00
	65MM	0.33	0.42	0.41	0.35	0.36	0.33	0.37	0.04	6.00
8MM	35MM	0.32	0.34	0.30	0.27	0.26	0.23	0.29	0.04	6.00
	50MM	0.29	0.31	0.38	0.38	0.36	0.32	0.34	0.04	6.00
	65MM	0.39	0.34	0.38	0.27	0.37	0.30	0.34	0.05	6.00

2023100150

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=PUFF(/CIG)

MODULUS LOW

		REPLICATES														
		1	2	3	4	5	6	7	8	9	10	11	12			
		RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	AVG	STD	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	35MM	8.20	8.80	8.00	8.40	8.20	8.20	8.10	8.20	8.00	8.70	7.70	8.40	8.24	0.30	12.00
	50MM	8.60	8.80	8.60	8.20	8.40	8.20	8.80	8.60	8.00	7.40	8.70	8.30	8.37	0.40	12.00
	85MM	8.40	8.80	7.80	8.20	7.60	8.20	7.80	7.60	8.00	8.60	8.40	8.40	8.15	0.39	12.00
6MM	35MM	8.20	8.20	8.40	8.00	8.30	8.10	8.20	8.00	8.70	8.30	7.70	8.30	8.20	0.24	12.00
	50MM	7.90	8.40	8.60	9.00	8.00	8.10	8.60	8.00	8.20	8.40	8.40	7.70	8.29	0.38	12.00
	85MM	8.10	8.40	8.20	8.30	8.60	8.30	8.60	8.10	8.20	7.80	8.70	8.40	8.31	0.26	12.00
8MM	35MM	8.40	8.40	8.60	8.60	8.40	8.10	8.10	8.20	8.90	8.40	8.20	8.40	8.38	0.23	12.00
	50MM	8.20	8.80	8.20	8.40	8.40	8.20	8.40	8.40	8.30	8.70	8.40	8.10	8.37	0.21	12.00
	85MM	8.70	8.10	8.80	8.70	8.20	8.10	8.00	8.30	8.50	8.40	8.80	9.00	8.30	0.57	12.00

MODULUS MEDIUM

		REPLICATES														
		1	2	3	4	5	6	7	8	9	10	11	12			
		RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	AVG	STD	N
INSERTION LENGTH	PRESSURE(MM OF HG)															
4MM	35MM	8.20	8.10	8.40	7.70	7.80	8.70	8.50	7.90	8.40	8.40	7.80	7.60	8.12	0.36	12.00
	50MM	7.90	8.00	8.10	8.00	7.70	7.50	8.80	8.50	8.50	8.30	8.50	8.20	8.17	0.37	12.00
	85MM	8.20	8.30	7.90	7.80	7.10	8.30	8.70	8.20	8.10	8.20	8.10	8.20	8.09	0.38	12.00
6MM	35MM	8.30	8.20	8.40	8.20	7.80	8.00	8.20	8.60	8.20	8.40	8.80	8.80	8.33	0.28	12.00
	50MM	8.00	7.60	8.40	8.00	8.50	8.10	7.80	8.20	8.40	8.20	8.40	8.60	8.18	0.30	12.00
	85MM	8.60	8.00	8.50	8.80	8.40	8.80	8.80	8.10	8.80	8.70	8.20	8.40	8.50	0.29	12.00
8MM	35MM	6.80	8.30	8.20	8.50	8.60	8.30	8.00	8.60	7.60	8.70	8.00	8.40	8.16	0.52	12.00
	50MM	8.40	7.60	8.00	8.60	8.00	8.60	8.20	8.40	8.00	8.40	7.80	8.40	8.27	0.48	12.00
	85MM	8.80	8.40	8.00	8.10	8.60	8.70	8.00	8.20	8.20	7.50	8.70	8.10	8.36	0.42	12.00

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE-FILTER_EFFICIENCY(%)

MODULUS LOW

		REPLICATES								
		1	2	3	4	5	6			
		RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	AVG	STD	N
INSERTION LENGTH	PRESSURE(MM OF HG)									
4MM	35MM	76.9	76.3	77.8	74.4	75.8	75.6	76.16	1.16	6.00
	50MM	75	76.9	70.8	76.6	72.6	76.3	74.67	2.48	6.00
	85MM	71.4	71.9	68.4	77.2	71.9	70.1	71.82	2.96	6.00
6MM	35MM	76.9	78	76.9	72.2	78.6	79.1	76.95	2.49	6.00
	50MM	80	73.9	80.6	80	76.5	73.1	77.17	3.38	6.00
	85MM	60.9	71.2	71.7	68	70.8	73.8	69.40	4.66	6.00
8MM	35MM	83.9	81.3	80	78	71.8	81.3	79.38	4.18	6.00
	50MM	77.8	78.5	78.6	76.6	78.9	73.2	77.10	2.19	6.00
	85MM	76.6	73.9	74.6	72.7	78	70.8	74.20	2.61	6.00

MODULUS MEDIUM

		REPLICATES								
		1	2	3	4	5	6			
		RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	RES-ULT	AVG	STD	N
INSERTION LENGTH	PRESSURE(MM OF HG)									
4MM	35MM	75	76.7	83.3	74.1	80.6	77.1	77.80	3.50	6.00
	50MM	75.9	73.6	70.6	79.4	71.1	81.6	75.37	4.46	6.00
	85MM	70.5	67.5	74.2	73.6	76.9	78.4	73.50	4.03	6.00
6MM	35MM	78.4	80.6	80.6	75.7	88.9	82.8	81.33	4.38	6.00
	50MM	80.8	80	80.4	84.4	76	80	80.10	3.00	6.00
	85MM	73.3	76.4	70.7	70	72	76.7	73.18	2.84	6.00
8MM	35MM	78	81	81.1	77.1	79.8	79.3	79.22	1.60	6.00
	50MM	80.6	88.6	80.9	80.9	76.6	78	80.93	4.15	6.00
	85MM	79.6	76.8	74.6	73	76.6	73.2	75.23	2.41	6.00

Figure B1 (cont.)

LISTING OF SMOKE ANALYSES FOR INDIVIDUAL PORTS BY MODULUS, INSERTION LENGTHS AND PRESSURES WITH 12MM HOLDER

VARIABLE=H2O(MG/CIG)

MODULUS LOW

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.24	0.18	0.08	0.16	0.20	0.17	0.17	0.05	6.00
	60MM	0.16	0.23	0.22	0.16	0.16	0.08	0.17	0.06	6.00
	85MM	0.16	0.23	0.24	0.08	0.15	0.25	0.18	0.07	6.00
6MM	35MM	0.16	0.14	0.12	0.10	0.09	0.13	0.12	0.03	6.00
	60MM	0.27	0.19	0.12	0.15	0.28	0.15	0.19	0.07	6.00
	85MM	0.41	0.20	0.24	0.15	0.18	0.14	0.22	0.10	6.00
8MM	35MM	0.14	0.06	0.09	0.14	0.16	0.06	0.11	0.04	6.00
	60MM	0.20	0.16	0.13	0.28	0.17	0.17	0.18	0.06	6.00
	85MM	0.18	0.14	0.18	0.18	0.13	0.14	0.16	0.02	6.00

MODULUS MEDIUM

INSERTION LENGTH	PRESSURE(MM OF HG)	REPLICATES 1 RESULT	2 RESULT	3 RESULT	4 RESULT	5 RESULT	6 RESULT	AVG	STD	N
4MM	35MM	0.15	0.15	0.13	0.21	0.18	0.22	0.17	0.04	6.00
	60MM	0.24	0.29	0.28	0.19	0.18	0.15	0.22	0.06	6.00
	85MM	0.15	0.18	0.18	0.22	0.20	0.16	0.18	0.02	6.00
6MM	35MM	0.16	0.12	0.11	0.21	0.14	0.17	0.15	0.04	6.00
	60MM	0.15	0.26	0.22	0.14	0.30	0.19	0.21	0.06	6.00
	85MM	0.18	0.12	0.15	0.16	0.14	0.12	0.14	0.02	6.00
8MM	35MM	0.15	0.16	0.19	0.16	0.30	0.20	0.19	0.06	6.00
	60MM	0.12	0.16	0.21	0.20	0.24	0.13	0.18	0.05	6.00
	85MM	0.18	0.20	0.12	0.19	0.11	0.17	0.16	0.04	6.00

APPENDIX C

ANALYSES OF VARIANCE FOR SMOKING DATA

Figure C1

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=TAR(MG/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	8.54268519	0.50251089	6.79	0.0001	0.561981	30.9542
ERROR	90	6.65833333	0.07398148		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	107	15.20101852			0.27199537		0.87870370

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.30083333	4.07	0.0467	1	0.30083333	4.07	0.0467
INSET_LG	2	1.14240741	7.72	0.0008	2	1.14240741	7.72	0.0008
MODULUS*INSET_LG	2	0.13722222	0.93	0.3993	2	0.13722222	0.93	0.3993
PRESSURE	2	6.39574074	43.23	0.0001	2	6.39574074	43.23	0.0001
MODULUS*PRESSURE	2	0.05722222	0.39	0.6804	2	0.05722222	0.39	0.6804
INSET_LG*PRESSURE	4	0.37537037	1.27	0.2883	4	0.37537037	1.27	0.2883
MODULUS*INSET_*PRESSU	4	0.13388889	0.45	0.7704	4	0.13388889	0.45	0.7704

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0739815

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	0.93148	54	LOW
B	0.82593	54	MEDIUM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0739815

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	1.2222	36	85
B	0.7250	36	50
B	0.6889	36	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0739815

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	INSET_LG
A	0.98333	36	4
A A			
A	0.81389	36	6
B	0.73889	36	8

Figure C2

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=NICOTINE(MG/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	0.11846296	0.00696841	8.09	0.0001	0.604414	25.6379
ERROR	90	0.07753333	0.00086148		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	107	0.19599630			0.02935100		0.11018519

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.00592593	6.88	0.0102	1	0.00592593	6.88	0.0102
INSET_LQ	2	0.01572407	9.13	0.0002	2	0.01672407	9.13	0.0002
MODULUS*INSET_LQ	2	0.00331296	1.92	0.1522	2	0.00331296	1.92	0.1522
PRESSURE	2	0.08500741	49.34	0.0001	2	0.08500741	49.34	0.0001
MODULUS*PRESSURE	2	0.00311852	1.81	0.1696	2	0.00311852	1.81	0.1696
INSET_LQ*PRESSURE	4	0.00428148	1.24	0.2987	4	0.00428148	1.24	0.2987
MODULU*INSET_*PRESSU	4	0.00109259	0.32	0.8659	4	0.00109259	0.32	0.8659

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=8.6E-04

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	0.11759	54	LOW
B	0.10278	54	MEDIUM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=8.6E-04

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	0.14833	36	85
B	0.10056	36	60
C	0.08167	36	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=8.6E-04

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	INSET_LQ
A	0.12417	36	4
A			
A	0.11167	36	6
B	0.09472	36	8

2023100156

Figure C3

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=CO(MG/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	7.13913568	0.41994916	5.42	0.0001	0.318807	58.2818
ERROR	197	15.25416667	0.07743232		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	214	22.39330233			0.27826663		0.47741880

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.07743300	1.00	0.3185	1	0.07743300	1.00	0.3185
INSET_LQ	2	0.59702569	3.86	0.0228	2	0.59702569	3.86	0.0228
MODULUS*INSET_LQ	2	0.11224792	0.72	0.4857	2	0.11224792	0.72	0.4857
PRESSURE	2	5.69022569	36.74	0.0001	2	5.69022569	36.74	0.0001
MODULUS*PRESSURE	2	0.19969792	1.29	0.2774	2	0.19969792	1.29	0.2774
INSET_LQ*PRESSURE	4	0.35870806	1.16	0.3306	4	0.35870806	1.16	0.3306
MODULU*INSET_*PRESSU	4	0.10423061	0.34	0.8531	4	0.10423061	0.34	0.8531

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=197 MSE=.0774323

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=107.498

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	MODULUS
	A	0.51298	108	LOW
	A			
	A	0.47670	107	MEDIUM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=197 MSE=.0774323

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=71.6636

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	PRESSURE
	A	0.71111	72	85
	B	0.45070	71	50
	C	0.32083	72	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=197 MSE=.0774323

WARNING: CELL SIZES ARE NOT EQUAL.
HARMONIC MEAN OF CELL SIZES=71.6636

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN	GROUPING	MEAN	N	INSET_LQ
	A	0.55694	72	4
	A			
B	A	0.49722	72	8
B				
B		0.42817	71	6

Figure C4

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=FILTER_NICOTINE(MG/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	0.24086667	0.01416863	6.25	0.0001	0.541314	13.8927
ERROR	90	0.20410000	0.00226778		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	107	0.44496667			0.04762119		0.34277778

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.00030000	0.13	0.7169	1	0.00030000	0.13	0.7169
INSET_LQ	2	0.02106667	4.64	0.0120	2	0.02106667	4.64	0.0120
MODULUS*INSET_LQ	2	0.00535556	1.18	0.3117	2	0.00535556	1.18	0.3117
PRESSURE	2	0.17111667	37.73	0.0001	2	0.17111667	37.73	0.0001
MODULUS*PRESSURE	2	0.01567222	3.46	0.0358	2	0.01567222	3.46	0.0358
INSET_LQ*PRESSURE	4	0.02263333	2.50	0.0484	4	0.02263333	2.50	0.0484
MODULUS*INSET_*PRESSU	4	0.00472222	0.52	0.7208	4	0.00472222	0.52	0.7208

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0022678

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	0.34444	54	LOW
A			
A	0.34111	54	MEDIUM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0022678

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	0.39167	36	85
B	0.34250	36	50
C	0.29417	36	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE,
NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0022678

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	INSET_LQ
A	0.35722	36	4
A			
A	0.34722	36	6
B	0.32389	36	8

2023100158

Figure C5

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=PUFF(/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	2.49541667	0.14678922	1.08	0.3763	0.084793	4.4608
ERROR	198	26.93416667	0.13603114		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	215	29.42958333			0.36882400		8.26805556

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.13004630	0.96	0.3284	1	0.13004630	0.96	0.3284
INSET_LQ	2	0.63194444	2.32	0.1007	2	0.63194444	2.32	0.1007
MODULUS*INSET_LQ	2	0.40898148	1.50	0.2249	2	0.40898148	1.50	0.2249
PRESSURE	2	0.07694444	0.28	0.7540	2	0.07694444	0.28	0.7540
MODULUS*PRESSURE	2	0.38453704	1.41	0.2458	2	0.38453704	1.41	0.2458
INSET_LQ*PRESSURE	4	0.61944444	1.14	0.3396	4	0.61944444	1.14	0.3396
MODULU*INSET_*PRESSU	4	0.24361852	0.45	0.7741	4	0.24361852	0.45	0.7741

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=198 MSE=0.136031

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	8.2928	108	LOW
A			
A	8.2435	108	MEDIUM

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=198 MSE=0.136031

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	8.2847	72	85
A			
A	8.2778	72	50
A			
A	8.2417	72	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=198 MSE=0.136031

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	INSET_LQ
A	8.3097	72	8
A			
A	8.3028	72	6
A			
A	8.1917	72	4

Figure C6

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=FILTER_EFFICIENCY(%)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	1068.15333333	62.71490196	5.83	0.0001	0.524131	4.2978
ERROR	90	967.98333334	10.75537037		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	107	2034.13666667			3.27953813		76.30555556

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	131.12037037	12.19	0.0007	1	131.12037037	12.19	0.0007
INSET_LG	2	140.69555556	6.54	0.0022	2	140.69555556	6.54	0.0022
MODULUS*INSET_LG	2	30.44740741	1.42	0.2482	2	30.44740741	1.42	0.2482
PRESSURE	2	645.60000000	30.01	0.0001	2	645.60000000	30.01	0.0001
MODULUS*PRESSURE	2	1.29851852	0.06	0.9416	2	1.29851852	0.06	0.9416
INSET_LG*PRESSURE	4	88.05444444	2.05	0.0945	4	88.05444444	2.05	0.0945
MODULU*INSET_*PRESSU	4	29.03703704	0.67	0.6111	4	29.03703704	0.67	0.6111

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=10.7554

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	77.407	54	MEDIUM
B	75.204	54	LOW

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=10.7554

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	78.472	36	35
A			
A	77.556	36	50
B	72.889	36	65

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=10.7554

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	INSET_LG
A	77.678	36	8
A			
B A	76.356	36	6
B			
B	74.683	36	4

Figure C7

ANALYSES OF VARIANCE FOR SMOKE DELIVERIES

VARIABLE=1120(NQ/CIG)

GENERAL LINEAR MODELS PROCEDURE

DEPENDENT VARIABLE: RESULT

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PR > F	R-SQUARE	C.V.
MODEL	17	0.09250463	0.00544145	2.03	0.0171	0.277302	29.7481
ERROR	90	0.24108333	0.00267870		ROOT MSE		RESULT MEAN
CORRECTED TOTAL	107	0.33358796			0.05175619		0.17398148

SOURCE	DF	TYPE III SS	F VALUE	PR > F	DF	TYPE IV SS	F VALUE	PR > F
MODULUS	1	0.00344537	1.29	0.2598	1	0.00344537	1.29	0.2598
INSET_LQ	2	0.00740185	1.38	0.2564	2	0.00740185	1.38	0.2564
MODULUS*INSET_LQ	2	0.00652407	1.22	0.3007	2	0.00652407	1.22	0.3007
PRESSURE	2	0.02696852	5.03	0.0085	2	0.02696852	5.03	0.0085
MODULUS*PRESSURE	2	0.01857963	3.47	0.0354	2	0.01857963	3.47	0.0354
INSET_LQ*PRESSURE	4	0.00755926	0.71	0.5902	4	0.00755926	0.71	0.5902
MODULUS*INSET_*PRESSU	4	0.02202593	2.06	0.0933	4	0.02202593	2.06	0.0933

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0026787

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	MODULUS
A	0.17963	54	MEDIUM
A			
A	0.16833	54	LOW

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

ALPHA=0.05 DF=90 MSE=.0026787

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

DUNCAN GROUPING	MEAN	N	PRESSURE
A	0.19250	36	50
A			
B A	0.17556	36	85
B			
B	0.16389	36	35

DUNCAN'S MULTIPLE RANGE TEST FOR VARIABLE: RESULT
NOTE: THIS TEST CONTROLS THE TYPE I COMPARISONWISE ERROR RATE, NOT THE EXPERIMENTWISE ERROR RATE.

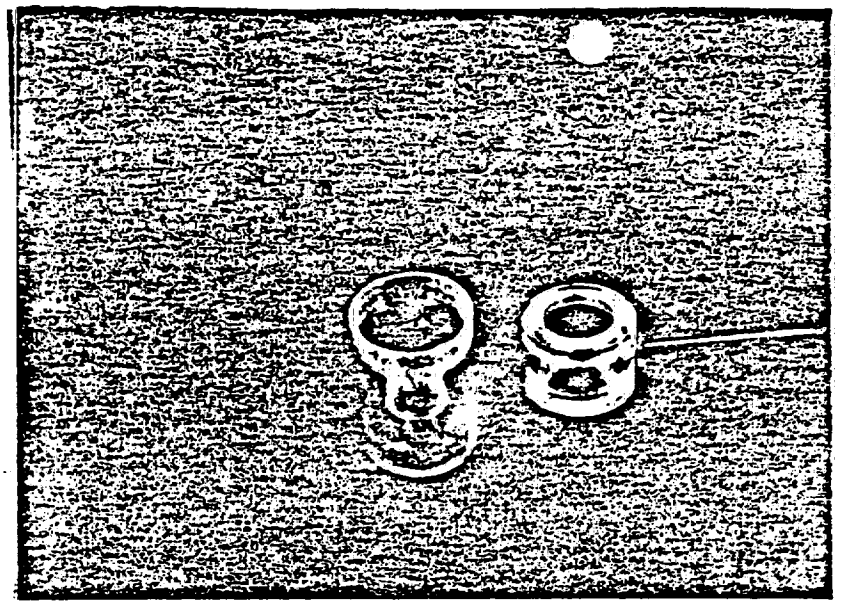
ALPHA=0.05 DF=90 MSE=.0026787

MEANS WITH THE SAME LETTER ARE NOT SIGNIFICANTLY DIFFERENT.

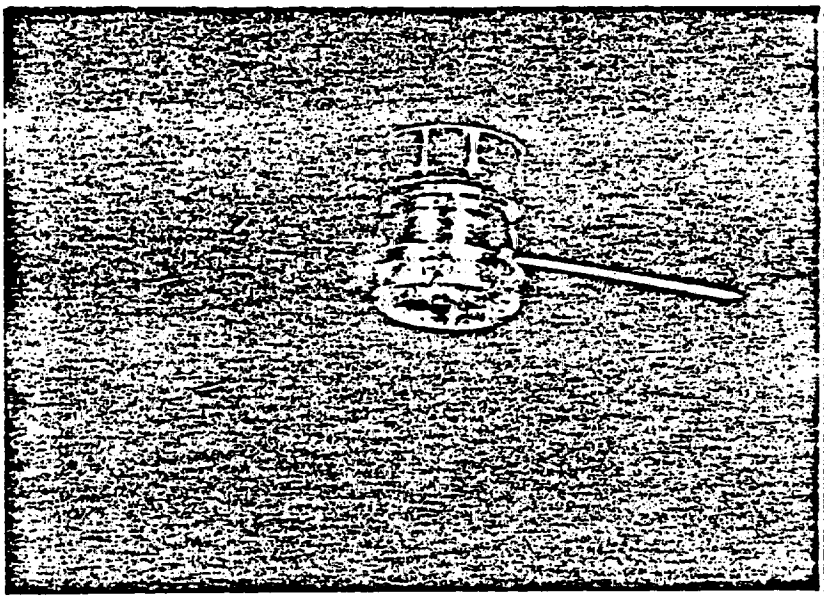
DUNCAN GROUPING	MEAN	N	INSET_LQ
A	0.18417	36	4
A			
A	0.17389	36	6
A			
A	0.16389	36	8

APPENDIX D

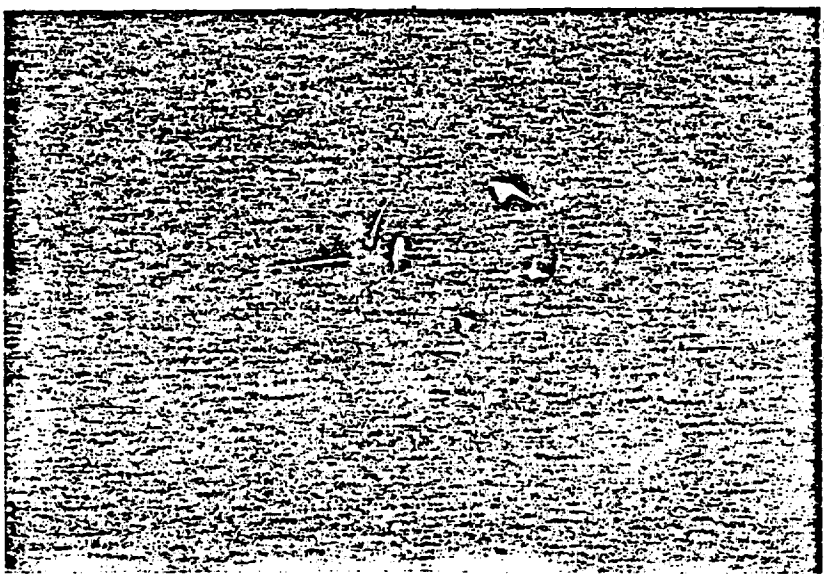
PHOTO DOCUMENTATION



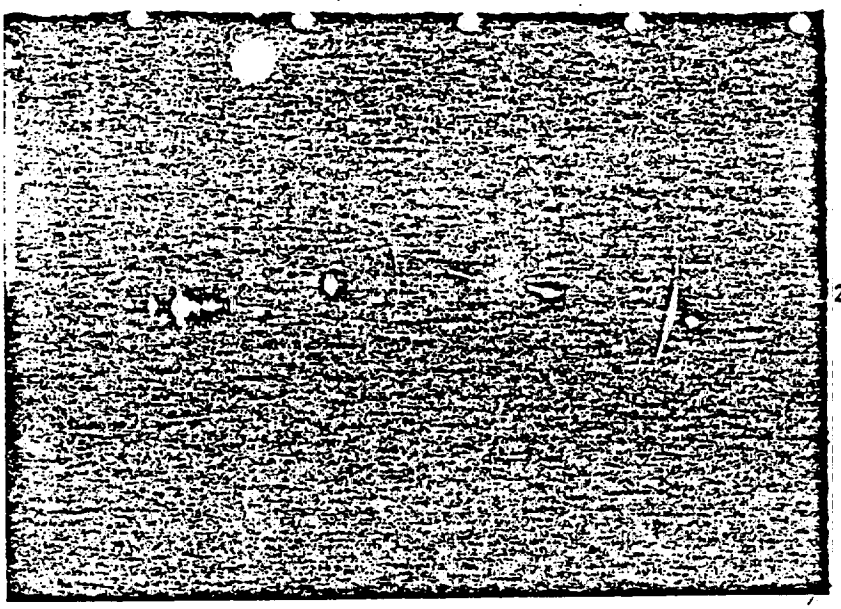
1a. Kamm holder components: O-rings, Kamm tube, and Kamm holder



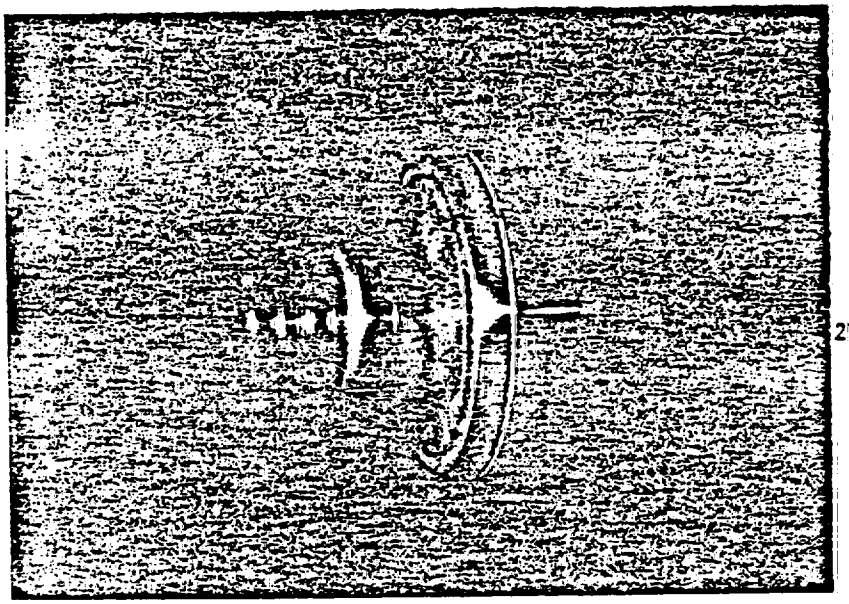
1b. Partially assembled Kamm holder



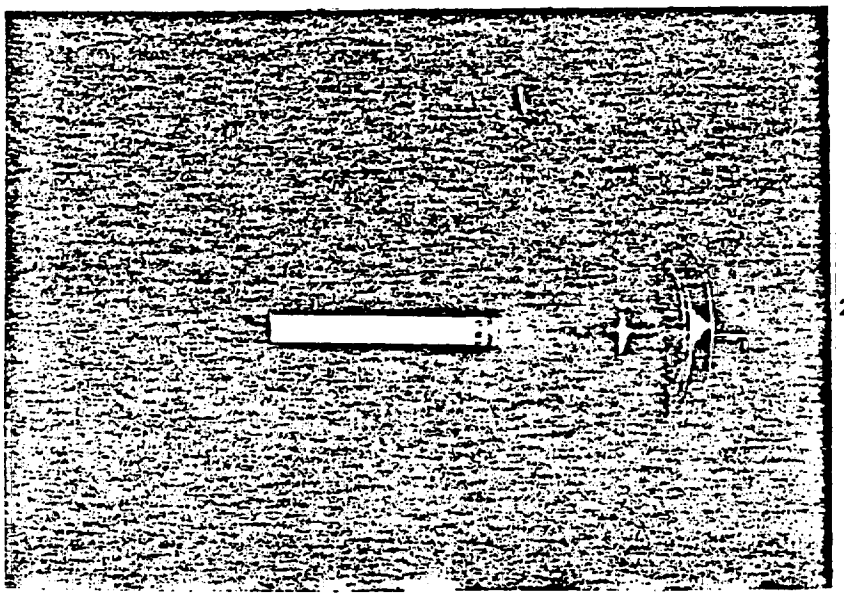
1c. Fully assembled Kamm holder



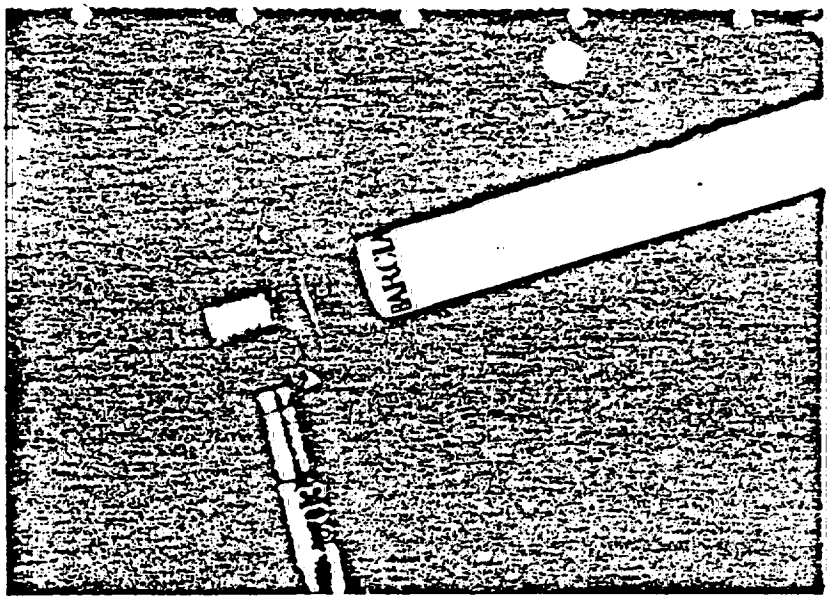
2a. Assembled Kamm holder, adapter collar, and Gelman filter



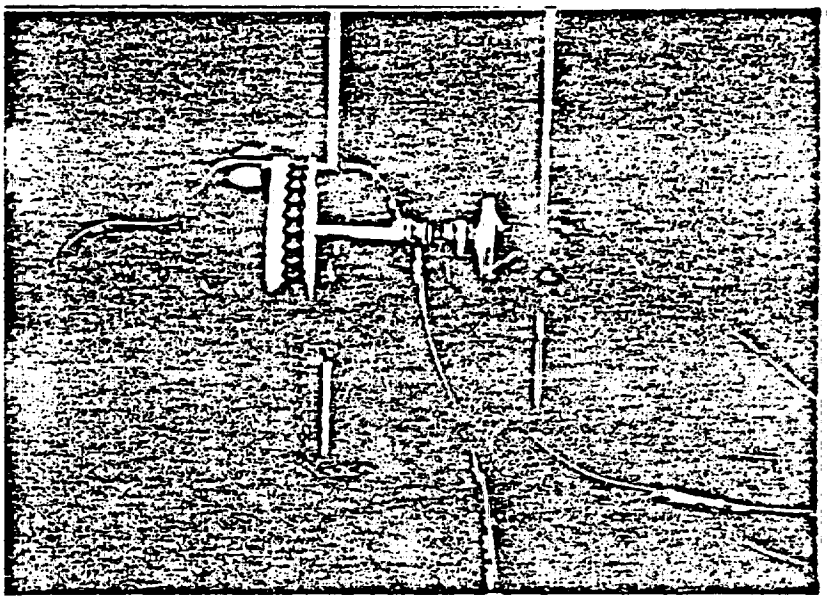
2b. Fully assembled Kamm holder and Gelman filter



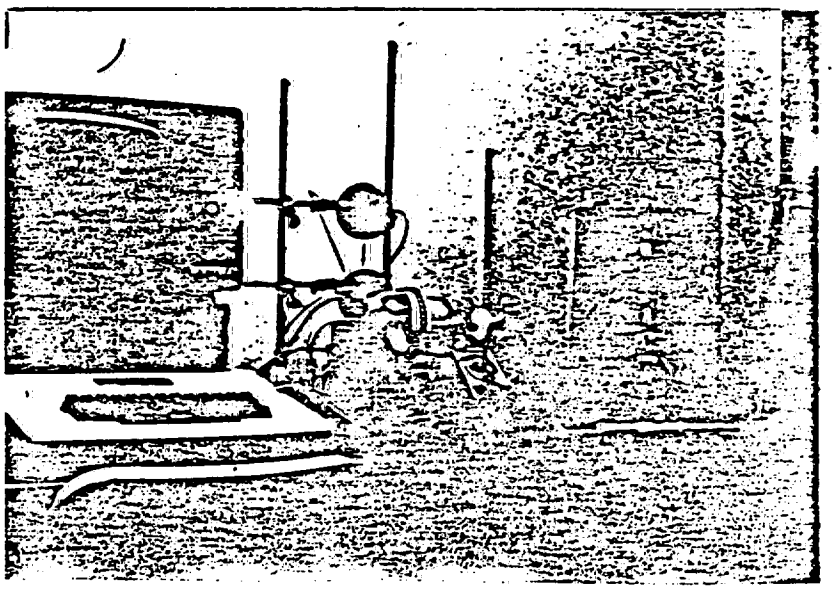
2c. Assembled Kamm holder and Gelman filter with cigarette



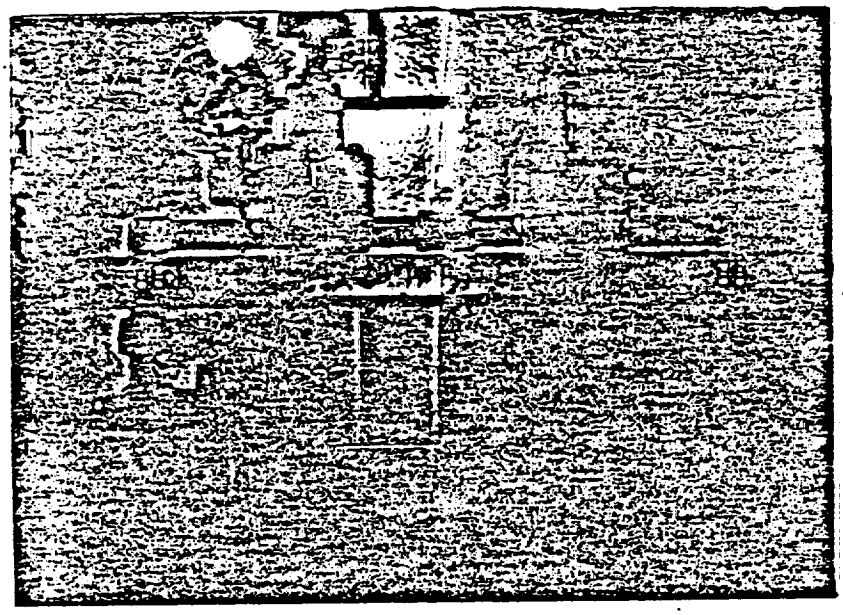
3a. Filtrona ventilation sleeve with cigarette



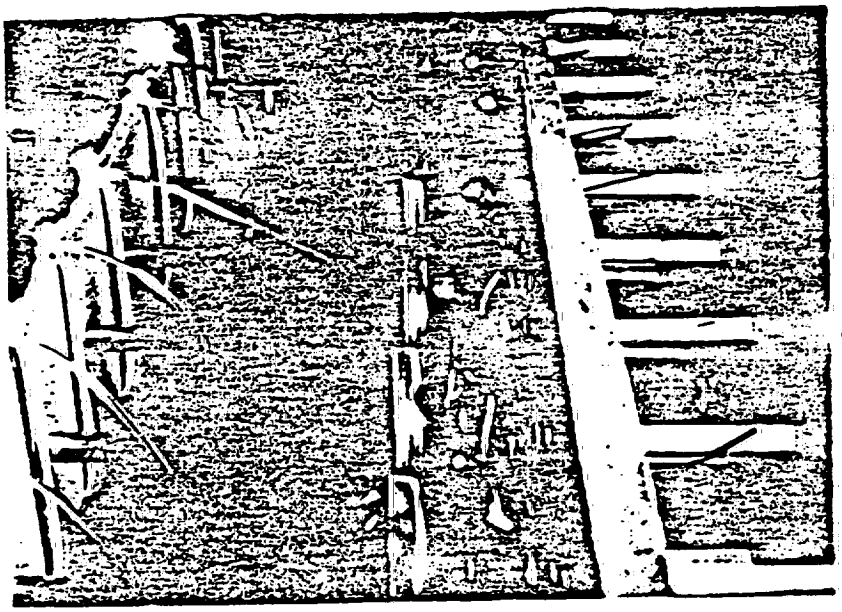
3b. Puff profile analyzer (PPA) with ventilation sleeve and Kamm holder in place



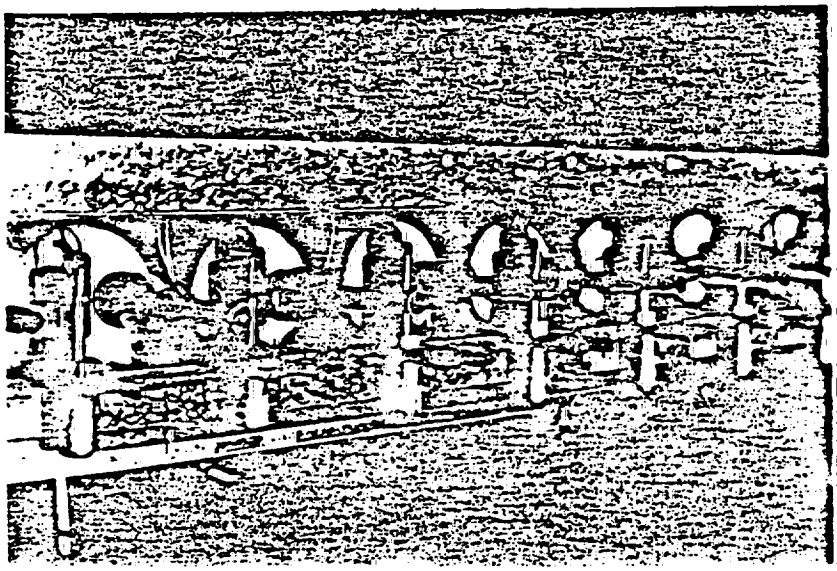
c. Complete ventilation study apparatus



4a. Pressure/vacuum manifold serving two Phipps & Bird smoke machines



4b. Side view of Phipps & Bird smoke machine with Kamm holders in place



4c. Front view of Phipps & Bird smoke machine with Kamm holders in place